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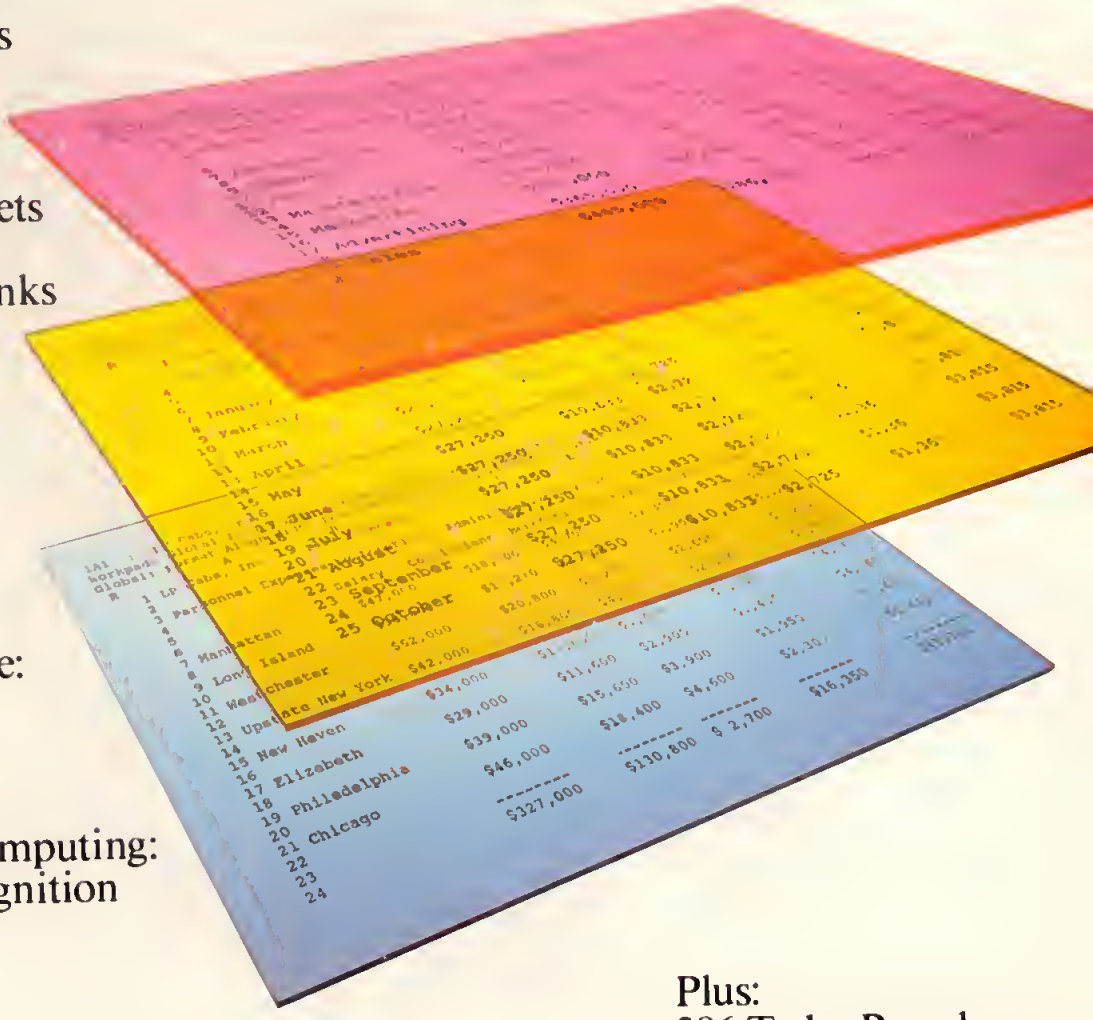
PC MAGAZINE

VOLUME 6 NUMBER 18
OCTOBER 27, 1987

Power Beyond 1-2-3

PC Labs Tests

- 10 Spreadsheets That Go Lotus One Better
- 3-D Spreadsheets That Provide the Missing Links



- Laptop Update: New Screens, New Players
- Hands-off Computing: 15 Voice-Recognition Boards
- EGA on the Big Screen: 6 Show-stopping, Presentation-size Monitors

Plus:
- 386 Turbo Boards
- The New MultiMate
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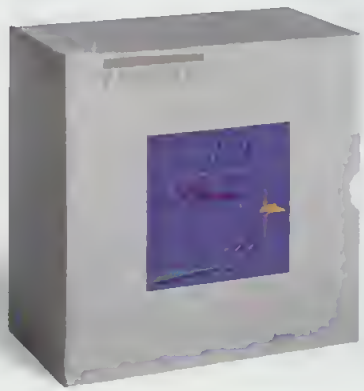

PARADOX

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Even better, R66 systems give you all this high performance computing power at about half the price of other comparable machines. For instance, compare the Dart R66 to the IBM PS/2™ Model 60 and AST Premium/286™ Model 140. They all share the same 10-MHz 80286 processor, which offers compatibility with IBM's OS/2, the newest generation of more powerful multitasking software. And they all feature the same first-rate design and first-class components. Yet the R66 still costs as little as half as much.

Break the Speed Limit.

In computing, like cross-country travel, speed is of the essence. And R66 systems deliver the power to take you wherever you want to go. Fast.

But to get outstanding PC performance, it takes more than just an 80286 or 80386 processor. Which is why every component in R66 systems is carefully designed for maximum overall system speed.

For example, R66 hard disks are rated at 28 ms average access time, 30% faster than the IBM Model 60. And R66 hard disks use 1:1 interleave for even faster disk operation, unlike AST's hard disk. R66 systems also transfer data from disk to memory at a scorching 390 KB/s, a full 50% faster than the other machines. The result? Fewer processing bottlenecks and faster system performance.

Soup Them Up.

If you're working on arithmetic-intensive graphics or database applications, the Dart R66 is socketed for 80287 coprocessor support, and the ALR 386/2 R66 is socketed for both 80287 and 80387 coprocessors.

And if you need the ultimate in flat-out speed, ask about the ALR 386/2 R66 equipped with 20-MHz processor speed.

	ALR Dart R66	ALR 386/2 R66	IBM PS/2 Model 60	AST Premium/286 Model 140
Price	$2295	$3490	$5295	$3495
Microprocessor	10-MHz 80286	16-MHz 80386	10-MHz 80286	10-MHz 80286
Hard disk	66 MB, 28 ms	66 MB, 28 ms	44 MB, 40 ms	44 MB, 28 ms
Data transfer rate	390 KB/s	390 KB/s	255 KB/s	255 KB/s
Interleaving	1:1	1:1	1:1	2:1
RAM	1 MB expandable to 2 MB on system board	1 MB expandable to 2 MB on system board	1 MB	1 MB
Coprocessor support	80287	80287 and 80387	80287	80287
Serial/parallel ports	2/2	1/1	1/1	1/1

Room to Roam.

Advanced Logic Research R66 systems come with a 66-MB hard disk that's a full 50% larger than the ones you'll find on IBM and AST's machines. So you'll have half again as much disk space to spread out in.

Remember When R-66 Meant Speed to Burn and Room to Play?

ALR IBM and AST

With a 50% faster transfer rate from disk to memory, R66 systems are just the ticket for high speed, disk-intensive computing.

And speaking of more space, since the system board has room for an extra 1 MB of RAM in addition to the 1 MB already installed, memory expansion doesn't have to mean fewer available expansion slots.

With its combination of processing power and disk space, R66 systems are ideal for graphics applications like CAD/CAM and desktop publishing.

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If you're yearning for more speed, more room, or both, then test-drive an R66 system at your nearby Advanced Logic Research dealer, one of over 700 nationwide.

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Get the name of the nearest Advanced Logic Research dealer by calling (714) 581-6770. Then get behind an R66 system and discover the difference that extra speed to burn and room to play can make.

Specifications

Dart R66 $2295

- ALR-designed multilayer system board
- 80286-10 microprocessor
- Socketed for 80287 support
- 1 MB RAM, expandable to 2 MB on system board
- 66-MB, 28-ms hard disk drive
- 1.2-MB, 5 1/4-inch floppy disk drive; 3 1/2-inch drives optional
- Two serial and two parallel ports
- Phoenix BIOS
- Optional EMS software
- Eight expansion slots
- Floormount configuration
- 101-key keyboard
- Shown with optional graphics adapter and monitor

ALR 386/2 R66 $3490

- ALR-designed multilayer system board
- 80386-16 microprocessor, 20-MHz CPU speed optional
- Socketed for 80287 and 80387 support
- 1 MB 32-bit, 80-ns RAM, expandable to 2 MB on system board
- 66-MB, 28-ms hard disk drive
- 1 serial, 1 parallel port
- Phoenix BIOS
- 32-bit control software: Vdisk, disk caching, EMS and EEMS (optional)
- 1.2-MB, 5 1/4-inch floppy disk drive, 3 1/2-inch drives optional
- Eight expansion slots
- Floormount configuration
- 101-key keyboard
- Shown with optional graphics adapter and monitor

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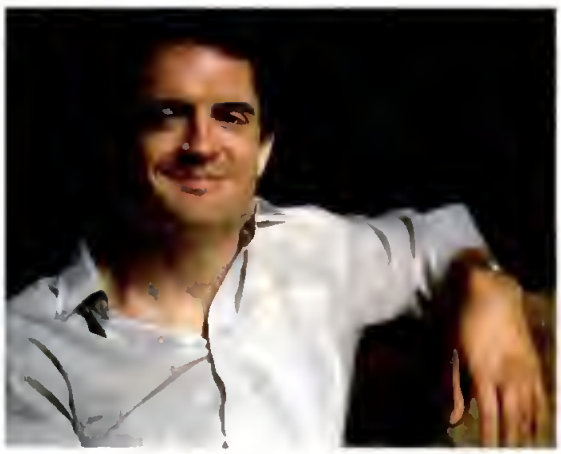
WHAT'S INSIDE

1-2-3 climbed to the top shortly after Lotus Development Corp. released it in January 1982. It's been there ever since.

In this issue *PC Magazine* examines its challengers. Many best *1-2-3* on price, some on power. PC Labs tested 15 traditional and 3-D spreadsheets for speed and features. One stood out—and it wasn't *1-2-3*. Our reviews (see page 91) tell you what we found, which is best, and why none of these challengers is likely to loosen Lotus's hold on the spreadsheet market.



Strong on spreadsheets: Jared Taylor, West Coast editor, headed this issue's review of spreadsheets.

We're not kidding ourselves. Despite our choice, *1-2-3* will remain the market leader among the present host of offerings. But that could change as three major-league players release spreadsheets. Microsoft's *Excel*, a top-selling spreadsheet in the Apple world, was due out for the PC in October. Borland International has announced *Quattro*, and Surpass Software Systems—a new company backed by MicroPro International founder Seymour Rubenstein—unveiled *Surpass* at PC Expo in New York last month. A smaller but equally ambitious challenger is the Personal Computer Support Group (PCSG), a Dallas firm developing a 3-D RAM-resident spreadsheet called *Lucid 3-D*.

All this activity hasn't escaped notice at Lotus. The industry leader is working on Release 3, scheduled to appear in early 1988. We hope it and other vendors turn to our "1-2-3 Wish List," page 154, where editors Bill Howard, Jim Seymour, and Jared Taylor speak out on what they want from spreadsheets.

Jared, *PC Magazine*'s West Coast editor and the author of our Spreadsheet Clinic column since 1985, led the team that produced these reviews—the first of many you'll see here during the coming year. Jared bought his first PC—a 64K monochrome IBM—the year Lotus released *1-2-3*, and he started writing reviews on it for *PC Magazine* the following year. The 64K PC, he tells us, is still going strong.

Elsewhere in this issue you'll find a slick new utility—an easy-to-use clipboard that can cut and paste text from one place to another, print out ranges of figures your software has just calculated, steal long strings of commands and feed them into DOS, and capture just about anything from your display and put it into a file. If you want to make your hours at the keyboard a whole lot more productive, check out the free SNIPPER program—which does all this and more—in this issue's Utilities column, page 359. SNIPPER is the first of many terrific utilities we'll be bringing you by ace programmer Tom Kihlken. PC

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PC MAGAZINE

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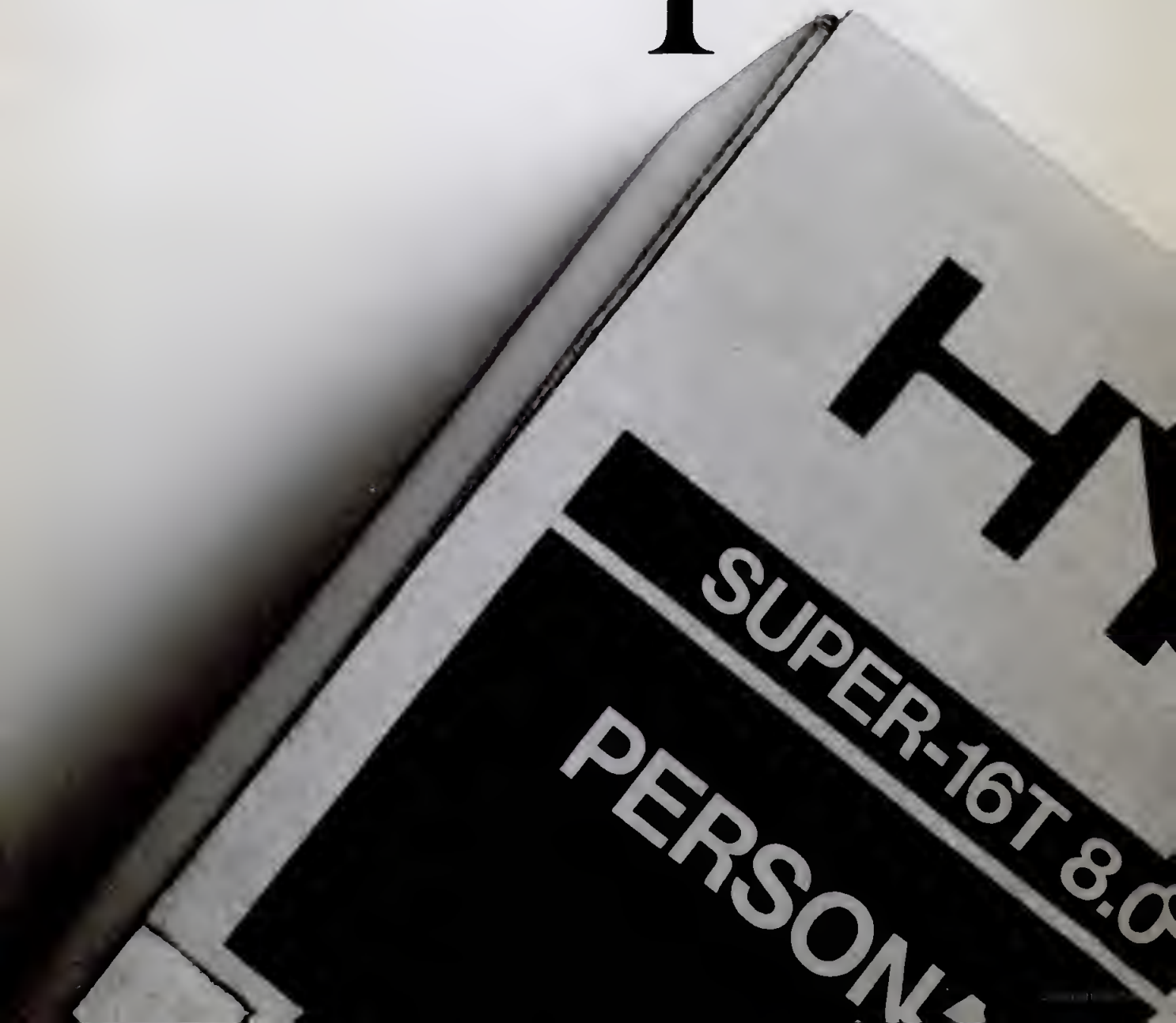

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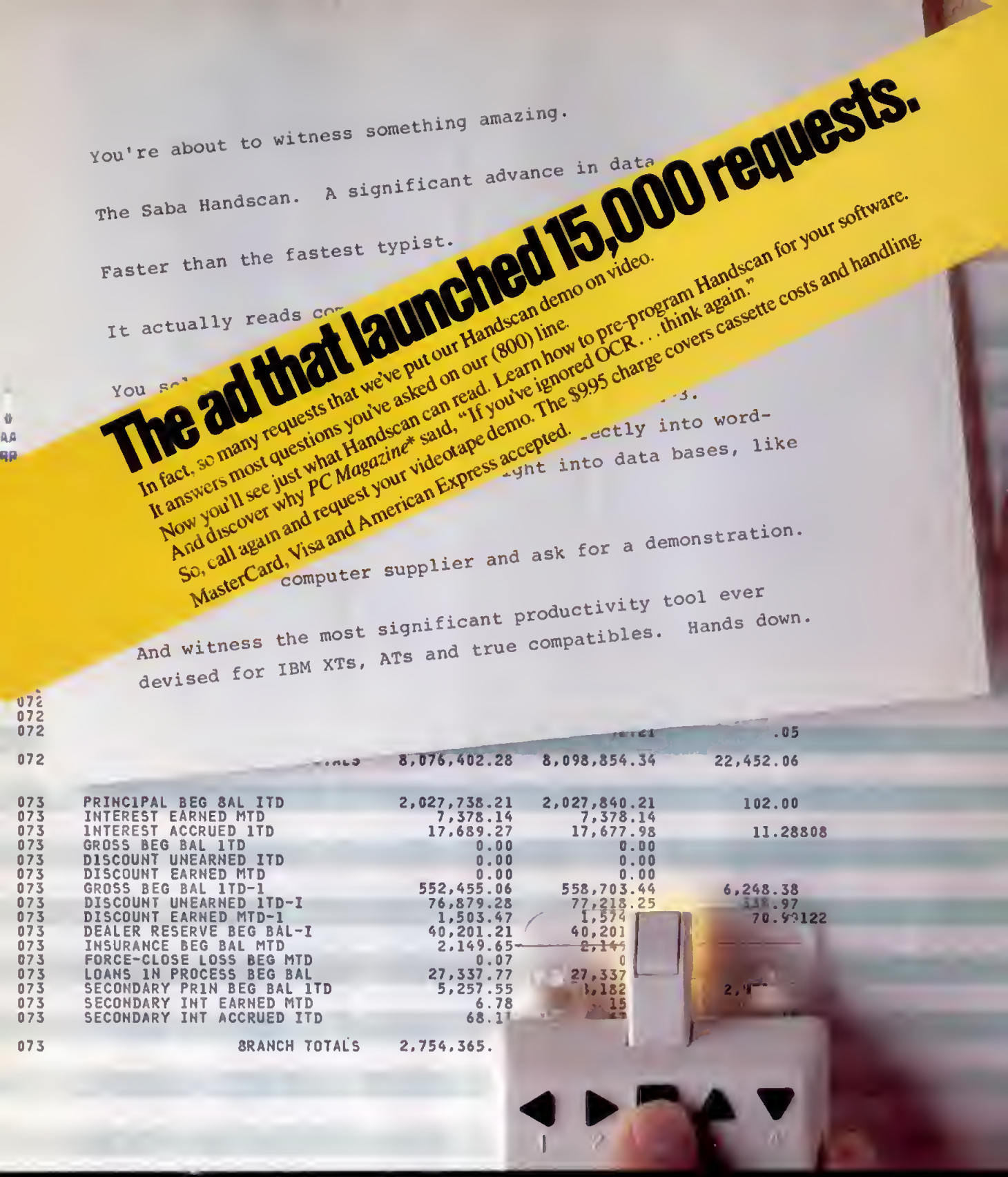

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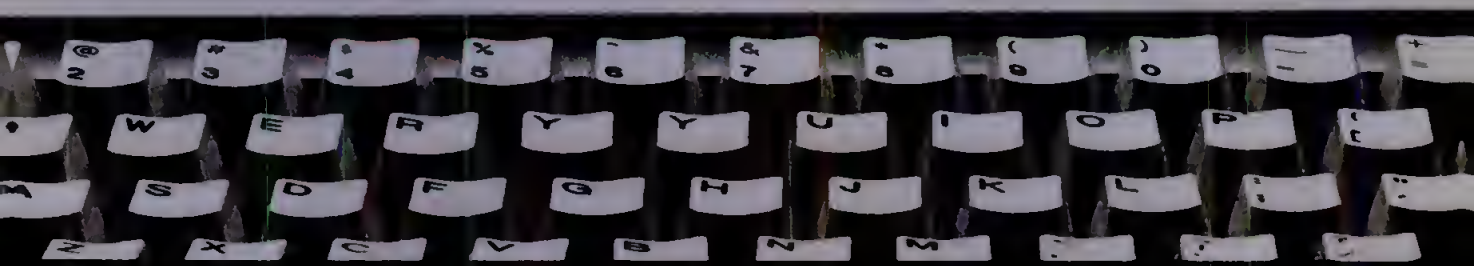

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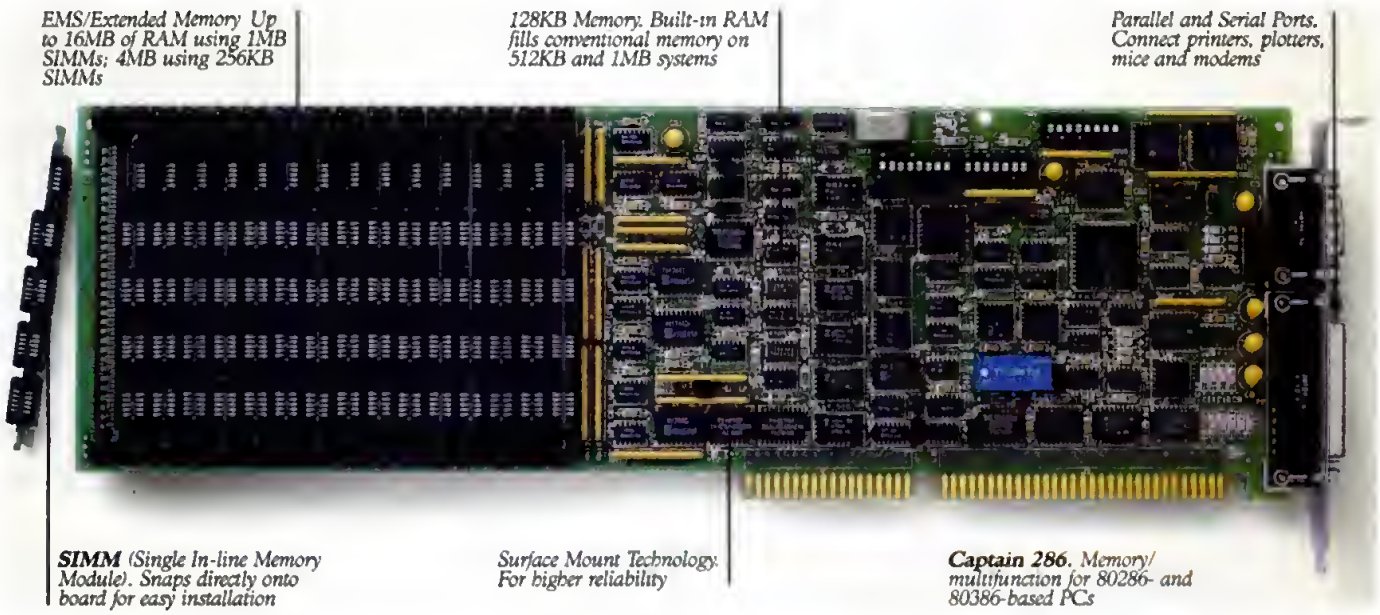

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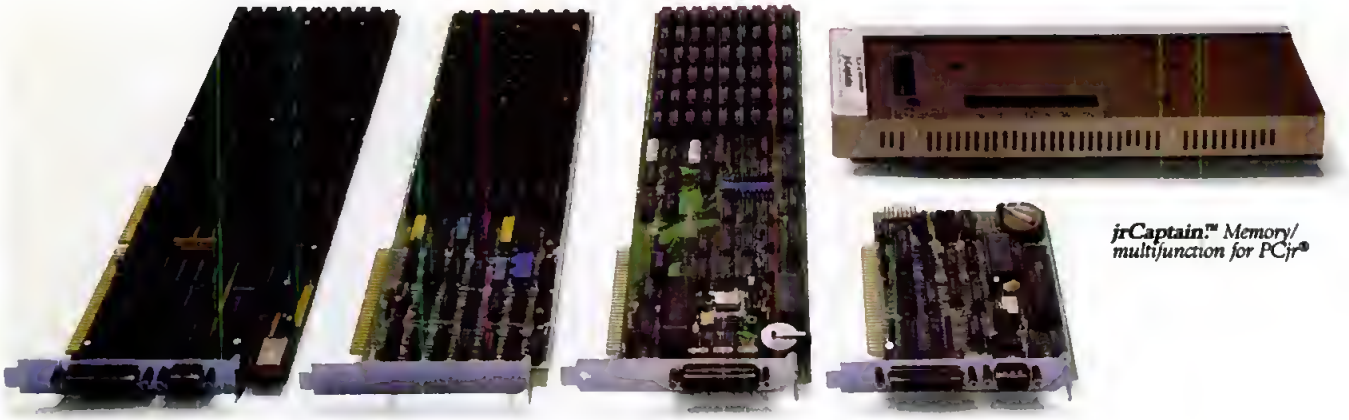

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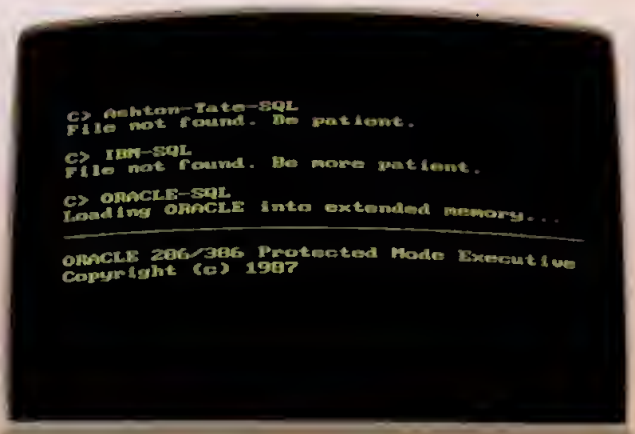

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CIRCLE 130 ON READER SERVICE CARD

LETTERS TO PC MAGAZINE

LAPTOP BATTLE

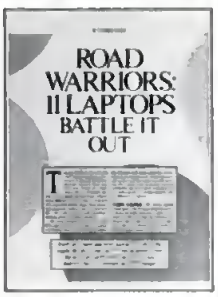
You really outdid yourselves with the thorough coverage of laptop offerings ("Road Warriors: 11 Laptops Battle It Out," *PC Magazine*, Volume 6 Number 13). As a laptop shopper, I especially appreciated your mention of third-party products that are available for these machines.

Jim Keersemaker
Livingston Manor, New York

The article on laptops ("Road Warriors: 11 Laptops Battle It Out") mentioned the Datavue's standard 8087 math coprocessor but left me wondering whether the NEC takes one. I would have liked a column reporting on 8087 status in one of the features tables.

Selby Evans
Fort Worth, Texas

Your article on laptops was generally well done ("Road Warriors: 11 Laptops Battle It Out"). However, it neglected to mention whether the machines were voltage switchable from the 110-volt/60-Hz usage in the United States to the 220-volt/50-Hz usage common throughout the world. For all users whose work requires them to travel, would you please include this information in the future?



Dr. J. F. Kenney
Rotterdam, Holland

Future articles on laptop portables will include information on support for math coprocessors and the ability to handle dual voltages.—Bill Howard

THOUGHTS ON THE PS/2

My compliments to your timely in-depth articles on the PS/2s and OS/2 operating system (*PC Magazine*, Volume 6 Number 13). Keep up the good work.

Bill Chau
San Francisco, California

In your relatively enthusiastic reviews of the IBM PS/2 computers ("IBM's Bold New Move," *PC Magazine*, Volume 6 Number 13), you offer little comment on the enhanced keyboard, which is available without choice on all the models. Although this keyboard is apparently becoming the standard, to those of us who are heavily dependent on the Ctrl and function keys, it is a regression.

In your June 9, 1987, issue, Michael J. Mefford wrote a program to swap the position of the Ctrl and CapsLock keys of the enhanced keyboard (User-to-User, *PC Magazine*, Volume 6 Number 11). Now if only some talented person would write a program to reposition the function keys arrayed across the top of the keyboard back to the left edge where they belong!

Rudi Schmid
Kensington, California

Having recently purchased two PS/2 Model 60s, I enjoyed reading Charles Petzold's sidebar ("Triple Standard: Three New Video Modes from IBM") on the new PS/2 monitors ("IBM's Bold New Move," *PC Magazine*, Volume 6 Number 13). Contrary to IBM and Mr. Petzold's measurements, the so-called 14-inch screen on the IBM 8512 is, in fact, only 13 inches from extreme corner to corner. The same goes for the 12-inch screen—it measures in at 11 inches. Are the monitor manufacturers fudging their numbers, or does the screen include that portion of the CRT that extends behind the surrounding monitor case?

Jim Henry
Oklahoma City, Oklahoma

IBM uses diagonal measurement, an industry standard, to obtain these figures. This method diagonally measures the glass from end to end—part of which is concealed under the monitor's bezel. In this case, it is the entire glass, and not just the viewing portion of the screen, that is measured.—Ed.

SHELL-SHOCKED

John C. Dvorak is right—there is a lot of software junk out there ("Sad Cures for User Idiocy," *PC Magazine*, Volume 6 Number 14). But to discount all DOS shells for all people is to forget the several hundred years he's spent becoming familiar with those obscure and often illogical DOS commands. If J. C. Dvorak is in doubt as to what constitutes useless and patronizing, perhaps he should look in a mirror.

Michael G. Reed
New York, New York

I object to John C. Dvorak's insulting remarks directed at users of DOS shells, online help facilities, and menu generators ("Sad Cures for User Idiocy"). I use a

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■ LETTERS

DOS shell, and it certainly makes my life a lot easier. Sure I know enough about DOS to find my way around a hard disk, and I can type long cumbersome DOS commands as well as anyone. But why should I go through all that trouble? I'm no dolt.

On the other hand, I have nothing but praise for Michael J. Mefford's splendid directory utility, DR.COM (Programming/Utilities, *PC Magazine*, Volume 6 Number 14). This utility does so many things so well that I can't help but wonder: Does Mr. Dvorak regard it as yet another sad cure for user idiocy?

Robert A. Burns
Dalton, Georgia

Mr. Dvorak is way off base ("Sad Cures for User Idiocy"). I must agree that if all Johnny does all day is view a directory and run *1-2-3* from his A: drive, he shouldn't play with shells. But he shouldn't be writing columns for *PC Magazine* either.

Samuel Moeller
New York, New York

It's so nice to receive personal attacks from understanding readers whom I don't know from Adam. I would like to ask these people a question: If DOS shells are so great, where are all the millionaires who designed this software?—John C. Dvorak

Please have more columns like John C. Dvorak's "Sad Cures for User Idiocy," in which he writes about useless software such as DOS shells. These programs, like bicycle training wheels, only hinder a user's speed and mobility on the keyboard.

S. Hamill Horne
Gladwyne, Pennsylvania

For once, I have to agree with John C. Dvorak ("Sad Cures for User Idiocy"). Our biggest problem in supporting our customers is dealing with their shells. It seems nobody knows what C> means. If anyone comes up with another "improvement," I'm going back to my abacus.

Boyd Wood
Tolland, Connecticut

A PERFECT 10

I was reading "PS/2 Top Ten Lists," by Stephen Manes (*PC Magazine*, Volume 6 Number 13), when I found myself laughing in my office. My compliments to Mr. Manes and his creativity in technical writing. I enjoy all his articles very much.

Afsi Okhovat
Del City, Oklahoma

Just finished reading "PS/2 Top Ten Lists" (Stephen Manes). I haven't laughed this hard in weeks. It was a riot!

Mark Wallace
Los Angeles, California

After reading your July 21, 1987, issue, I am fully convinced that not only is the PS/2 a joke, but OS/2 is one of the best pieces of vaporware I've never seen ("PS/2 Top Ten Lists"). Thank goodness for Stephen Manes and his humor to put the whole thing in perspective: The best feature of OS/2 *is* breaking the 640K barrier.

Roger D. Brown
Longview, Washington

EEMS OR EMS?

In "Taking Your AT's Memory to the Maximum" (*PC Magazine*, Volume 6 Number 14), the features table chart showed each of the 11 multifunction boards as being either EMS or EEMS compatible. Isn't EEMS just a superset of EMS, meaning that all EEMS-compatible boards are also EMS compatible? The table is misleading by implying that memory expansion boards can be one or the other but not both.

Peter A. Westcott
La Mirada, California

EEMS boards, pioneered by AST, have the Lotus/Intel/Microsoft expanded memory specification as a subset. As a practical matter, while EEMS is more flexible, not much software outside of DESQview *takes advantage of EEMS—yet.*—Bill Howard

AN APPROPRIATE PERSPECTIVE

I found Jim Seymour's column "Computers in Our Homes" (*PC Magazine*, Volume 6 Number 13) a refreshing point of view and one I wish I could get across to a large number of my clients. Thanks to Mr. Seymour for bringing this perspective into view.

Ermine Todd III
Bakersfield, California

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■ LETTERS

Jim Seymour is right on the money when he advocates the "appropriate" solutions in computing ("Computers in Our Homes"). As the owner of a PC consulting business, I can only agree with him.

Edward Fischer
New York, New York

GENUINE SHOWSTOPPER

I have used Kodak's Datashow System many times during the past few months. Two problems associated with the Datashow were not mentioned in its review ("On with the Show," *PC Magazine*, Volume 6 Number 13). First, some overhead projectors, especially older models, generate a lot of heat, causing the LCD image on the Datashow to gradually distort and eventually become dark and unreadable. Second, a presentation prepared for a color monitor may appear with blank spots on the screen because the background color will mask out the foreground color. These two problems can be avoided by checking the heat output of the projector, placing a thin piece of plexiglass between the surface of the projector and the Datashow, and reading the manual to see which combinations of colors may be used.

Randall L. Jones
Provo, Utah

Although color mapping was addressed, I did not address heat sensitivity because it did not become apparent during the evaluation, which used a cool-running system. Kodak's Datashow is admittedly a first-generation display. PC Magazine *will look at the new generation of overhead display systems in an upcoming issue.*
—Winn L. Rosch

MICE ATTACK

Your article on mice was a joke ("Mice for Mainstream Applications," *PC Magazine*, Volume 6 Number 14). It seemed to indicate that having more buttons to press is better than one, but at the same time it emphasized problems with mice due to discrepancies in the software world. Just listen to yourselves (press the Alt key and the left mouse button with *this* program and such and such will happen. . .). Sheesh.

Jeff Levering
Boston, Massachusetts

One- and two-button mice are easier for the casual user to comprehend. Three-button mice offer skilled users more options. For power users who want to take the time to learn the seven possible combinations, three-button mice are superior, especially since you can always duplicate the functions with the keyboard if you don't want to memorize all the combinations. What's unfortunate is that the dominance of the Microsoft mouse makes software developers unwilling to write applications that take advantage of more than two buttons. The lowest common denominator prevails.
—Bill Howard

CORRECTIONS/AMPLIFICATIONS

The NEC MultiSpeed does not offer an optional expansion chassis ("Road Warriors: 11 Laptops Battle It Out," *PC Magazine*, Volume 6 Number 13).

Central Point Software's *PC Tools*, Version 3.0, unformats, optimizes disk operation, and tests data integrity ("Back from the Brink: File Recovery Software," *PC Magazine*, Volume 6 Number 14).

Barry Watzman's *Perks-PC* does support directory functions, a separate phone directory that holds full names and addresses, and multiple appointment files ("TSR Desktop Organizers: More Features, Fewer Conflicts," *PC Magazine*, Volume 6 Number 14).

The correct price of Softstyle's *Printworks for Lasers* is $125 ("The Best of the Best Utilities," *PC Magazine*, Volume 6 Number 12).

HOW TO WRITE TO PC MAGAZINE

Do you have a comment, compliment, or criticism about something you've read in *PC Magazine*? A question you'd like to open up to other readers? Then send your opinion to Letters to PC Magazine, One Park Avenue, New York, NY 10016, or through MCI Mail to PCMAGAZINE.

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#492 PC-Type (3 disks)
#312 PC-Write (2 disks)

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#305 EZ-Forms
#645 FormGen

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#041 Qmodem (2 disks)
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#500 Tracer: uses LDS PAF system

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Design emphasizes objects Windows, databases, records and fields take the form of structures established outside functions, so you have complete control to change them

You can find such diversity in other libraries, but you'll need to buy several And there are added benefits to using one large collection Everything in one index, all under a common set of instructions Besides, Phoenix thinks even function libraries should have tutorials, source code demos, quick reference, and on-line help Our versions have pre-compiled libraries for all memory models of Lattice, Microsoft, CI86, Wizard and Aztec, and full source code to use with any other compiler Also a function prototype file to allow Pre-C to keep your calls precise

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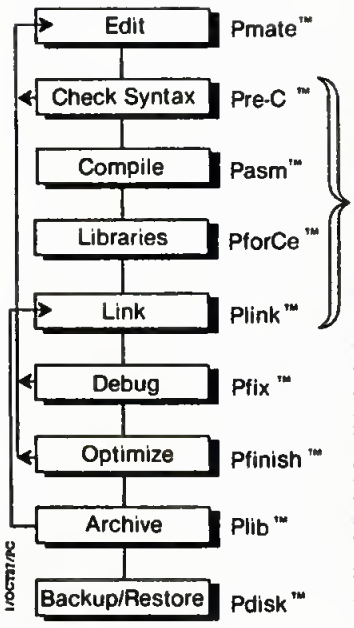

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Ask for	List	PC Brand
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Corporate PVCS	$395	$309
Network PVCS	Call	Call
PolyMake	$149	$109

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	List	PC Brand
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Kernel System	$495	$375
Metafile Interpreter	$295	$235

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SUPER SOURCE

Source Print

Author Alan Simpson writes "the best overall debugging technique is to draw lines to connect all the IF and DO WHILEs etc with their ENDIFs and ENDDOs Then use a pencil to"—Well thanks, Alan, but we'll use Source Print instead It draws those vertical lines to connect the beginnings and endings of structure in a vivid display of your program's organization It can print your programs with page numbers, headings, line numbers, indent automatically, throw in a table of contents and cross-reference index "Occasionally a utility comes along that makes a programmer's life much easier Source Print is such a program" says *PC Magazine* List **$75, Ours: $60.**

...add Tree Diagrammer

Tree Diagrammer prints an organization chart of your program's structure showing the hierarchy of function, procedure, and subroutine calls Shows at a glance what routines call each other for clearer debugging Every shop should have this important documentation tool List **$55** Ours **$45.**

C-TREE & R-TREE

B-Tree File Manager Now Has Report Generator

c-tree: The only major b-tree file manager with network support in the standard low-cost version c-tree™ gives you record-locking routines for DOS 3 1/3 2 UNIX and XENIX and it even comes in C source code, yet there are no royalties Source sticks to K&R so C-tree is portable Tests in many environments prove it

Permits any number of keys for a data file—alpha numeric even floating point Handles files with varied record lengths multiple keys in one index file Both high level and decomposed functions It's the works

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	List	Ours	Combined
c-tree	**$395**	**$329**	**$541**
r-tree	**$295**	**$245**	

WINDOWS for DATA

FIRST PRIZE!

M'Soft Windows Compatible

"Only one package can be easily recommended" said *Computer Language* (June '87) reviewing nine window and data entry products for C Complete field level functions specify prompt string, field length, data type, screen location, picture, target variable entry rules, help messages even functions to call for validation once data keyed in

Windows for C is a subset No data entry but all windowing functions Unlimited windows can be made either to pop up or permanently overwrite the screen, scroll and highlight lists vertically and horizontally Specify Compiler Windows for Data List **$395,** Ours **$349.** Windows for C List **$245,** Here **$216.**

ESSENTIAL C UTILITY LIBRARY

400 Functions, 30c Each

You've probably seen the speed and power of Essential's C function library without knowing it Software greats have been using it for some time to give today's top products pizazz and panache

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	List	PC Brand
C Utility Library	**$185**	**$119**
Essential Graphics	**$250**	**$183**
Essential Communications with Breakout Debugger	**$185**	**$125**
	$250	**$189**

Shopping List for the Power Workbench

	LIST	US
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Arity Combination Package	1095	979
Expert System Development Pkg	295	229
File Interchange Toolkit	50	44
PROLOG Compiler & Interpreter	650	569
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Arity PROLOG Interpreter	295	229
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EXSYS Runtime System	600	469
Insight 2+ *by Level Five Research*	485	379
Intelligence/Compiler *IntelligenceWare*	990	739
AI-LISP LANGUAGES		
IQCLISP *by Integral Quality*	300	Call
IQLISP *by Integral Quality*	270	Call
Microsoft LISP *Common LISP*	250	199
TransLISP *from Solution Systems*	95	Call
TransLISP PLUS *from Solution Syetems*	195	Call
AI-PROLOG LANGUAGES		
APT *Active Prolog Tutor from Solution Sys*	85	Call
MPROLOG Language Primer *LOGICWARE*	50	45
MPROLOG P500 *by LOGICWARE*	495	395
MPROLOG P550 *by LOGICWARE*	220	175
Prolog-86 *from Solution Systems*	125	Call
Prolog-86 Plus *from Solution Systems*	250	Call
Turbo PROLOG *by Borland Int'l*	100	83
Turbo PROLOG Toolbox *by Borland Int'l*	100	64
ASSEMBLERS & DEBUGGERS		
Advanced Trace-86 *Morgan Debugger*	175	119
C-Sprite Debugger *by Lattice, source level*	175	139
Microsoft Macro Assembler *with Utilities*	150	109
PASM86 *by Phoenix, Macro Assembler*	195	139
Periscope I Debugger *The Periscope Co.*	345	289
Periscope II *with NMI Breakout Switch*	175	139
Periscope II-X *software only*	145	105
Periscope III *with Advanced Board. New*	995	Call
BASIC LANGUAGES		
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Microsoft QuickBASIC Compiler *3.0*	99	79
BORLAND PRODUCTS		
Reflex & Reflex Workshop	200	129
Reflex *Date Base System*	150	89
Reflex Workshop	70	45
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Turbo C Compiler *New*	100	64
Turbo Lightning	100	64
Turbo Pascal & Tutor *New*	125	85
Turbo Pascal with 8087 & BCD	100	64
Turbo PROLOG Compiler	100	63
Turbo PROLOG Toolbox	100	64
Turbo Tutor	40	28
C COMPILERS		
C86 PLUS *by Computer innovations New*	497	397
Lattice C Compiler *from Lattice*	500	299
Let's C Compiler *by Merk Williams*	75	55
with CSD Source Level Debugger	125	90
MWC-86: Merk Williams C Development	495	369
Microsoft C Compiler *4.0*	450	295
Turbo C Compiler *by Borland. New*	100	64
C INTERPRETERS		
C-Terp *by Gimpel Software*	300	249
Instant C *by Rational Systems*	500	395
Interactive-C *by IMPACC with debugging*	249	219
RUN/C Professional *from Lifeboat*	250	185
COMMUNICATIONS		
Asynch Manager *by Blaise, for C or Pascal*	175	135
Greenleaf Communications *by Greenleaf*	185	139
C UTILITY LIBRARIES		
Blaise C TOOLS PLUS/5.0	129	99
Blaise Turbo C TOOLS	129	99
Blaise C TOOLS PLUS	175	135
C Food Smorgasbord *by Lattice*	150	109
C Utility Library *by Essential, 300 functions*	185	119
Greenleaf Functions *by Greenleaf Software*	185	139
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Microsoft COBOL Compiler	700	499
Microsoft COBOL Compiler *for XENIX*	995	795
Micro Focus COBOL *see Micro Focus Prod*		
dBASE SUPPORT		
BRIEF/dBRIEF *Brief for DBASE III*	275	Call
CLIPPER *from Nantucket*	695	375
McMAX *dBASE for MAC from Nantucket*	295	Call
dBx *dBASE to C Translator by DESKTOP At*	350	299
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with Full Source Code	1500	1282
dBC *from Lattice maintains DBASE files*	250	195
with source	500	390
dBC III Plus *supports multi-user DBASE*	750	595
with source	1500	1185
DEVELOPMENT TOOLS		
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BASIC-C *BASIC's functions added to C*	175	139
Report Option *Softcraft Btrieve Report Gen*	145	128
Xtrieve *Softcraft Query Utility for Btrieve*	245	220
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Dan Bricklin's **Demo Program** *Prototyper*	75	59
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Essential Comm Library	185	125
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PC BRAND PRESENTS RYAN-McFARLAND

FORTRAN WITH ENVIRONMENTAL IMPACT

NEW VERSION 2.4

A complete implementation of Fortran-77 (ANSI X3.9-1978), RM/FORTRAN was the first certified by the General Services Administration at the highest test level. The reason, it's a big mainframe compiler moved to PC's, with the bonus that mainframe and mini applications can wander between environments. What really sets RM/FORTRAN apart is the new RM/Forte project manager, a free bonus with version 2.4.

Now on your PC, you can develop large applications with programs up to 640k (bigger using overlays), arrays over 64k, and using a long list of VS, VAX and FORTRAN-66 extensions you may have grown fond of. Two years of successful conversions from mainframes by thousands of engineers and scientists prove that RM has it all.

Optimization reduces instructions to the minimum that will execute, even takes advantage of each processor's features to deliver lightning-fast object code. So there's scant reason left to queue up for the mainframe. Do development work fast on a PC and move the job after completion. Or move jobs off the mainframe or mini and switch for good.

Version 2.4 has "implicit none" to suspend default variable typing, complex 16, a Plink86 subset, a cross-reference compile option, IEEE floating point, 8087, 80287 and 80387 co-processor support, and inter-language calls in either direction between FORTRAN and C modules.

Austec's Ryan-McFarland has been writing FORTRAN compilers for IBM, DEC, etc. for 20 years, including IBM PC Professional FORTRAN and the new FORTRAN/2. So if FORTRAN's superiority for scientific and engineering applications is your need, there is no greater expert.

List **$595** PC Brand **$499**

RM/Forte Wraps an Environment Around FORTRAN

Ryan-McFarland has developed a comprehensive environmental shell to manage any number of FORTRAN projects. It has its own feature-packed editor, a split-screen debugger that toggles between source and program output, and a "make" which remembers your compile and link scripts. No more batch files. In fact, put your application in RM/Forte's windows and show DOS the door.

Select an application and RM/Forte's screen shows all its files. Point at one and choose any function in a bottom-screen menu: edit, compile, link, list, check syntax, whatever. Pop-up help and programmable function keys move you instantly between chores.

RM/Forte™ keeps status records of every file, when each was last compiled, error and warning counts, which modified files need re-compiling, even what needs doing next.

The cost? It is absolutely free with the new RM/FORTRAN v2.4.

COBOL WITH A DOUBLE STANDARD

OVER 500,000 INSTALLATIONS

If you want double or nothing, Austec's RM/COBOL-85 rolls both the 74 and 85 standards into a single compiler. It can compile your present applications without change, do it twice as speedily, store data in as little as a fifth the space, and run those programs up to eight times faster than earlier RM/COBOL's!

Converting applications from mainframes? In a single stroke you could move all development work to PC's, if not there already, and be up and running right away. No conversion downtime.

When ready for the 85 extensions, just set a command line option switch and add new features to your programs to give them the structure and performance the 85 standard adds to the language. You also get useful 74 features such as Sort-Merge and String-Unstring. The *one* compiler is GSA-certified error-free for *both* standards!

RM/COBOL-85 is designed for machine-independence. Develop on your PC with the confidence that your application can get along anywhere in the DOS, XENIX and UNIX worlds. Moreover, the RM/COBOL family expands to DOS networks and multi-user setups under UNIX™ and XENIX™. This is software from professionals.

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Add style to your work. Use new RM/Screens™ to open windows, pop up menus, and add contextual help to your programs. Design screens on the screen, with color and windows, and with data masks, validation, and help strings assigned to each entry field, and let RM/Screens convert images to COBOL. This code generator is the ideal way to jump right over the translation of tricky screen code from older COBOL applications and get to the RM/COBOL-85 level in a hurry. It will cobble your visions into 100% error-free COBOL on a shoestring. Then double your payoff and give your work a consistent user interface by copying and modifying screen designs all across your work.

List **$395** PC Brand **$335**

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RM/COBOL-85		**1250**	**995**
RM/COBOL-85	*Run Time*	**300**	**249**
RM/FORTRAN	*New 2.4*	**595**	**499**
RM/Screens		**395**	**335**

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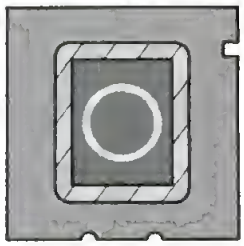

PC ADVISOR

Help in finding professional typing-tutorial software, in slowing down too-speedy software on an AT, and in finding a high-powered forms package.

SLOWING DOWN AN AT?

I picked up several shareware games for my new 8-MHz AT, but my computer is too fast for many of these games: the action is too quick for me to respond adequately.

Is there any software that will slow down the processing of games?

Magne Kristiansen
Colville, Washington

Charles Petzold offered an excellent slowdown program in PC Magazine*'s PC Tutor (Volume 5 Number 21). SLOWDOWN .COM sets up a do-nothing delay loop that runs every 55 milliseconds. You control the length of the delay loop, and thereby the effective speed of your system, by specifying an integer parameter ranging in value from 0 to 65535. If your copy of that issue walked away, don't fear: you can download the program from our Interactive Reader Service.*

You should also be able to find a similar utility on any substantial bulletin board or CompuServe, though some programs don't allow you to adjust the length of the delay loop. Look for programs named SLOW.ARC, SLOWDOWN.ARC, or DELAY.ARC.

In case you don't own a modem or just haven't got into the bulletin board spirit, you can get a slowdown utility named SLOW.COM on disk from The Public (Software) Library (Houston, Tex.; (713) 721-5205). For $5, you'll get about 30 other utilities on the disk as well, some shareware but most requiring no additional fee.

Finally, some software packages reprogram the timer chip or play other nasty little tricks, rendering this type of slowdown program useless. Megahertz Corp. offers a hardware solution that will speed up or slow down your IBM PC AT. The AT TurboSwitch II ($124.95; Megahertz Corp., Salt Lake City, Utah; (801) 485-8857) is a bit of a pain to install, and it will only slow your system down to 6 MHz. But for some games the difference between 8 and 6 MHz may be enough. PC Magazine *reviewed the TurboSwitch in the September 16, 1986, issue ("Speed Up your AT," Volume 5 Number 15, page 128).*

TYPING SCHOOL

Do you know of any professional, not-copy-protected, typing-tutorial software for PCs? I have *Typing Tutor III*, but after a time it is aggravating and counterproductive.

Donald L. Olson
Seattle, Washington

■ *Typing Tutor IV* offers lessons and tests that use real words and sentences instead of the letter combinations used in *Typing Tutor III*.

The best solution for your problem may be Typing Tutor IV *($49.95; Simon & Schuster Software, New York, N.Y.; (800) 624-0023; (800) 624-0024 in N.J.). Several aggravation-sparing enhancements over* Typing Tutor III *make the latest version more natural to use. For instance, you can now backspace to correct errors and type both upper- and lowercase characters.* Typing Tutor IV *also offers lessons and tests that use real words and sentences instead of the letter combinations used in* Typing Tutor III. *However, beginning typists are still forced to use the letter combinations until they reach a certain level of proficiency.*

Typing Tutor III *owners can upgrade to Version IV with a $25 charge plus postage and handling but should call Simon & Schuster for more information. For a more comprehensive look at* Typing Tutor IV, *turn to After Hours in the back of this issue. You'll find a comparative review of* Typing Tutor *and Broderbund's new challenger,* Type!.

FILING FORMS

I am looking for a program that will draw forms, let you fill out forms via some facsimile on the screen, and store the filled-in information in a database. What software do you suggest?

Joyce Wittich
Berkshire, New York

For an all-around easy-to-use, flexible package, go with FormTool, *Version 2.01 ($95; BLOC Development Corp., Miami Beach, Fla.; (800) 231-1149).*

■ PC ADVISOR

FormTool *stresses forms generation over data-file management, but its data merge features will give many users all the power they'll need. You can store filled-in information in a data file as you fill out a form or have the program fill out and print forms for you by merging in records from an existing file.*

Options for searching and editing FormTool *data files are crude at best. However, if you need to edit files or limit merging to records that meet specific conditions, you should be able to use your word processing, spreadsheet, or database software;* FormTool *directly reads ASCII and .DIF files and includes a simple procedure for linking forms to .DBF (*dBASE*-compatible) files. The link procedure works with files from any version of* dBASE.

If sophisticated data-handling features are more important to you than generating forms, you're better off with FormManager II *($99; BIT Software Inc., Milpitas, Calif.; (408) 262-1054).*

Creating forms isn't nearly as quick or as much fun with FormManager II, *and the package requires a greater investment of time to learn. But its database features give you all the data-handling power you'll need and then some.*

FormManager *lets you build a data file with fields from as many as ten separate forms. You can search data files for character strings, limit forms printing to records that meet certain criteria, and generate reports to summarize information in your data files. Macro capability and a nice range of math functions let you create formulas for any field.*

You can import only ASCII files, but FormManager *works directly with* dBASE III *and* III Plus *files, allowing you to create new* dBASE *files within* FormManager *or edit and use existing* dBASE *files.*

Both FormTool, *Version 2.01 and* FormManager II *are shipped with adequate documentation, and neither program is copy protected.*

TYPE CON > OBLIVION

Several readers have already noticed the lack of communication between my mind and fingers in PC Advisor, Volume 6 Number 15.

The correct DOS command for routing output from the keyboard to the printer one line at a time is TYPE CON > PRN, loosely translated as type from console (keyboard/screen) to printer. COPY CON PRN does nearly the same thing but prints all the lines of text at once when you enter Ctrl-Z to end input.

ASK THE ADVISOR

Send your questions to PC Advisor, *PC Magazine*, One Park Avenue, New York, NY 10016. Please specify your equipment configuration. PC

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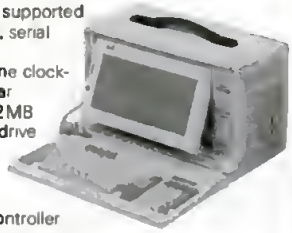

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- 80287 supported
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- Monochrome Graphics card with Printer Port
- One 1.2MB floppy drive
- Hard drive/floppy drive controller
- AT style keyboard
- 200 watt power supply
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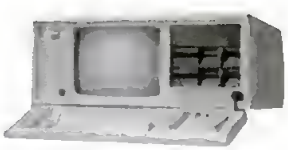

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If you're thinking about which "Post-it Note" program to buy, stop thinking. SmartNotes Version 2 beats the competition hands down.

Important new features make SmartNotes™ Version 2 the best note program for 1-2-3.™ And SmartNotes is the only note program that works with all your software. *There's absolutely no reason to use anything else.*

If you've already bought a note program, keep reading. For a limited time you can take advantage of a very special trade-in offer and get SmartNotes instead!

PC MAGAZINE

INFO WORLD 1986 PRODUCT OF THE YEAR

What if you had to push a button to see those little yellow notes on your paperwork? That would be crazy! And yet, every competing note program expects you to push a button to look for notes on your screen. Think about that. You need to *remember* to look for reminders. Only SmartNotes Version 2 has automatic note pop-up.

And what if those little yellow notes could only stick to ledger paper? C'mon! But only SmartNotes lets you attach notes to word processing documents, database and accounting records, directories, program listings AND 1-2-3.

Just because SmartNotes works with all your software, don't think it falls short on 1-2-3. Version 2 is tightly integrated with 1-2-3 so notes *always* stay securely attached. If you're a power-user, you'll appreciate exclusive SmartNotes features. Like the ability to attach notes to 1-2-3 database records. And conditional notes that pop up only if a test is satisfied. And compatibility with other Lotus add-on programs. *There is simply no better way to annotate 1-2-3 worksheets.*

New features in Version 2 make it remarkably easy to use. Picture this: You've just finished noting assumptions in 1-2-3 and you switch to your word processor. You bring in a proposal and PRESTO, a note pops-up. No buttons to push. No commands to remember. And you don't need to fuss with note files. Everything is automatic.

SmartNotes runs on any IBM PC, XT, AT, PS/2 or compatible. $79.95. Not copy protected.

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CIRCLE 282 ON READER SERVICE CARD

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Bill Goodbeu; President

At Peachtree Software, we listened to our customers and Complete II is our response to your requests. We've made the best selling accounting software even better with the features you wanted most, yet kept it priced at just $199 — a 96% reduction from the original $4,800.

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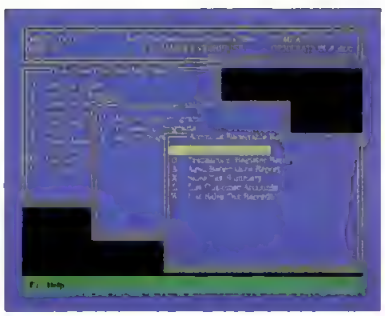

The changes in Peachtree Complete II are clearly visible to the user. The system has a whole new look, with benefits that are more than just cosmetic. For example, windows and pop-up menus make it easy to see where you came from and what you're doing in each application.

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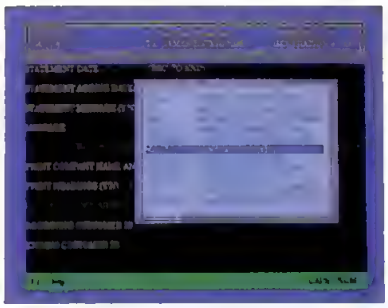

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- NEW Financial statements displayed on screen or printed
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- Repeating journal entries
- NEW Financial Statement comparisons may include current period and year-to-date with budget and/or prior period comparison

Accounts Receivable/Invoicing
- Open item or balance forward customers
- Up to 14,400 customers
- Simultaneous updating of inventory and A/R data files at time of invoice entry
- Supports partial payments
- NEW Service invoices
- NEW User-defined terms code
- NEW Automatic transactions with monthly, bi-monthly, quarterly, semi-annual, and annual frequency options
- NEW Enhanced county, city and state sales tax handling
- NEW User-definable aging periods for open item and balance forward customers
- Automatic calculation of finance charges
- Invoices and statements printed on plain or pre-printed forms

Accounts Payable
- Selection of invoices for payment based on user-defined discount and due dates
- Up to 14,440 vendors
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- Cash requirements forecasting by due date
- NEW User-defined billing cycle on automatic invoices
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- NEW Ability to void checks
- NEW Optional reprinting of checks
- NEW Check printing from 9 different bank accounts
- NEW Prints monthly check register

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Hardware Specifications

Requires PC/MS-DOS version 2.0 or higher with 384K of usable memory and a minimum 10 MB hard disk. For use with the IBM® PC, PC XT, PC AT, Personal System/2™ and compatibles. 3½" media optionally available. IBM is a registered trademark and Personal System/2 is a trademark of International Business Machines. Not copy protected.

*Plus $12.50 shipping and handling. Money-back guarantee does not apply to upgrades.

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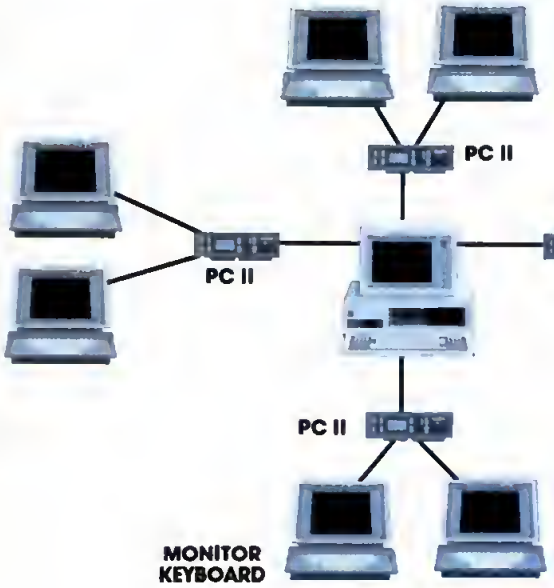

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PC MAGAZINE

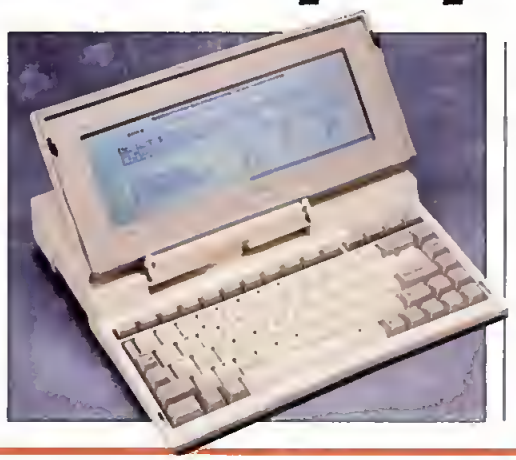
FIRST LOOKS

Toshiba's 6.4-Pound T1000 Is the Lightest Laptop Yet

PC HANDS ON

BY HOWARD MARKS

Big advances have been made in DOS-compatible laptop computers in the last year. Backlighting and supertwist LCDs have made screens sharper than ever, miniaturized hard disks from JVC have expanded storage to 10 megabytes in a 16-pound computer, and a choice of CGA or MDA has meant a wide range of compatibility with the programs on your desktop computer.



The Toshiba T1000 resembles the T1100 Plus, but it's smaller by several inches in width and depth. The T1000 has one 3½-inch disk drive and DOS stored on a ROM chip for instant booting.

Toshiba America, which had a lot to do with this laptop revolution, is bucking the trend. Its new T1000 sacrifices a few of the amenities we've come to expect from new laptops but delivers the essentials in a sturdy 6.4-pound package.

There's no backlighting, only one 3½-inch, 720K-byte disk drive, and at 9½ by 3¼ inches, the screen is small.

(continues on page 35)

Microsoft Crams a Bookshelf of Reference Works on CD-ROM

PC HANDS ON

BY PAUL SOMERSON

I bought my first PC 6 years ago figuring it could run a powerful collection of reference programs just like the ones supplied with *Microsoft Bookshelf*. Only faster.

This sizzling new CD-ROM product is what computers are all about. Microsoft Corp. snagged the rights to *The American Heritage Dictionary* (with biographical and geographical sections), a stripped-down *Roget's Thesaurus*, *The World Almanac and Book of Facts*, *Bartlett's Familiar Quotations*, *The Chicago Manual of Style*, a spelling checker, a usage guide, a collection of business letters and forms, a business directory, and a ZIP code guide and squeezed them all through a sturdy user interface and lookup engine. The result is an astonishing tool for businesspeople, secretaries, students, researchers, and writers of all sorts. And considering that it frees you totally from juggling heavy reference books on your lap and poring over fine print, it's a steal at $295.

But wait—if you're smashing open the piggy bank as you read this, you may want to hold on for a minute. First you have to plunk down somewhere around $800 to buy an overpriced reader. Then you have to figure out how to install it; the contradictory and nonintuitive instructions that came with my Amdek reader made the riddle of the Sphinx look like a comic book. And when you finally get it pieced together, you truly learn the meaning of patience.

Still, is it worth the wait? Absolutely. It's exhilarating to have all that information at your fingertips; it's just annoying to have to wait the few seconds each time to summon it. Users of today's systems are spoiled by lightning-fast access. It's not really Microsoft's fault that *Bookshelf* isn't as nimble as it should be. This technology is available now only because of the proliferation of audio CD players. However, audio CD

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HANDS-ON INDEX

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Photograph: Thom O'Connor

Vista Opens New Spectrum of 16 Million Colors at 1K Resolution

PC HANDS ON

BY GERARD KUNKEL

AT&T's semiautonomous Imaging Center has once again expanded the graphics horizon by a few more miles. In 1985, the TARGA board brought true-color video images to the PC, and now the Vista Graphics Controller uses the Texas Instruments 34010 graphics coprocessor to take graphics processing another leap forward.

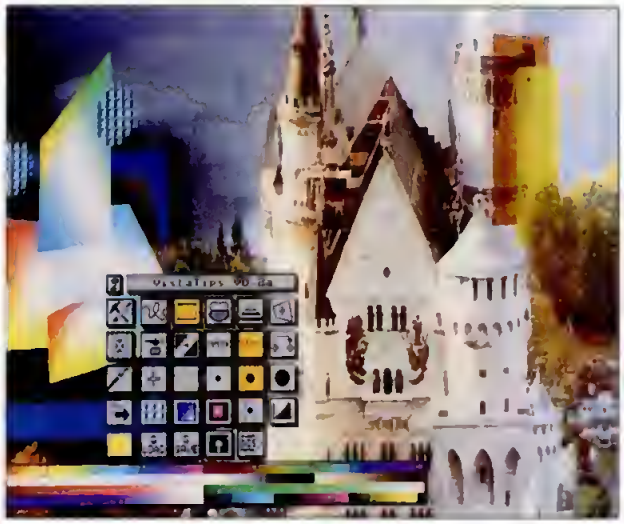
A true 32-bit image processor, the Vista is capable of displaying full-screen graphics in several modes: 16 million colors at a resolution of 1,024 by 1,024 dots; 32,000 colors at 2,048 by 1,024 dots; and 256 colors in super-sharp 2,048- by 2,048-dot resolution.

The Vista crams 4K bytes worth of dual-ported CMOS video RAM, the TI graphics processor, video input and output ports, input and output look-up tables (LUTS), and video genlock into one slot. With the TI coprocessor, the time to display complex graphics is drastically reduced.

The Vista requires an RGB analog display or can be configured to produce a composite video signal. At $5,995, this is not an average investment in a display adapter. The Vista has been created to answer the needs of professional graphics applications, such as video production, business graphics, solid modeling, computer animation, and image processing.

Just as the popular TARGA (TrueVision Advanced Raster Graphics Adapter) line of boards, Vista's predecessor, allowed for a true-color image capture via a video camera or color scanner, the Vista does that and more. This board is capable of displaying in RGB analog, NTSC composite, and PAL composite formats. And because it's a true 32-bit graphics processing environment, an image can be scrolled and panned quickly and smoothly, using as many colors as the display can handle.

Accessing this power right now is a feat for programmers only: we evaluated the board with Island Graphics' *TIPS* paint program, which is due to go on sale in the fall. A driver for *Microsoft Windows* is expected by year's end. Other image capture and enhancement programs are in the works, but as of press time, programmers were still busy trying to understand and capture the power of this new standard in high-resolution graphics.



At a top resolution of 2K by 2K bytes, the AT&T Vista Graphics Controller can generate 256 colors; in a 1K by 1K mode, it displays 16 million.

PC MAGAZINE FACT FILE

Vista Graphics Controller
AT&T Electronic Photography and Imaging Center
7351 Shadeland Station
Indianapolis, IN 46256
(800) 858-TRUE
List Price: $5,995
Requires: RGB or multiscan monitor.
In Short: Super-hi-res graphics adapter with TI 32-bit graphics coprocessor and 4K bytes of RAM. Software to utilize the board's spectacular potential is not yet available.

CIRCLE 442 ON READER SERVICE CARD

Bookshelf

(continued from page 33)

players are built for serial retrieval, not random access. (If your system can handle it, you can speed things up a bit by giving *Bookshelf* a 300K-byte EMS RAMdisk cache, but even then it seems to do a lot of unneeded disk churning.)

It's also galling that the CD reader costs four times as much as a CD Walkman and is four times as bulky. The added expense is allegedly for sophisticated error correction, but the first time I browsed through the Hemingway section in *Bookshelf*'s *Bortlett's*, I read:

"All modern American literature comes from one book by Mark Twain called and his romantic awe of them and how he had started a story once that began, "The very rich are different from you and me." And how someone had said to Julian, "Yes, they have more money."

Microsoft built in lots of nice touches. For example, while the almanac is crammed with tables wider than your screen, *Bookshelf* permits you to freeze one column's location and shuffle others over to it until the two you need are right next to each other. And it not only looks up the proper ZIP code for you while you are typing a letter but drops it in right after the city and state.

Exporting any *Bookshelf* data to your applications is a snap. Help is always available, and a clear on-ROM tutorial steps you through the few tricky parts (although the program is so easy to use that you don't really even need one).

You can purchase *Bookshelf* bundled with an Amdek reader for just under $1,100, but the price should really be about half that. Still, once you have the reader you can run other CD software on it. And once you try *Bookshelf* you will be hooked—having a real dictionary, thesaurus, almanac, and *Bortlett's* on-line is nothing short of magical.

PC MAGAZINE FACT FILE

Microsoft Bookshelf
Microsoft Corp.
16011 NE 36th Way
Redmond, WA 98073
(800) 426-9400
(206) 882-8088
List Price: $295; Amdek CD reader and *Bookshelf* software, $1,099 (available from Amdek Corp. at (800) PC-AMDEK).
Requires: 640K RAM (512K RAM for hard disk systems), two disk drives, additional CD-ROM disk drive with MS-DOS CD-ROM extensions, DOS 3.0 or later.
In Short: The CD reader's too expensive, and it drags its foot a bit, but serious writers and businesspeople will wonder how they ever got along without *Microsoft Bookshelf*. Truly innovative and exceedingly useful.

CIRCLE 441 ON READER SERVICE CARD

Toshiba T1000

(continued from page 33)

But the T1000 is a case of less being more. The design is brilliant. DOS is stowed on a ROM chip for instant booting. The 12¼- by 2- by 11-inch package fits in an ordinary briefcase. It runs on a charge for 5 hours and can keep up to 384K bytes of its RAM active during power-down. At $1,199, this machine creates a new class of light, portable computer.

A couple of pounds heavier than Tandy's Model 100, it's far more powerful.

Of course, Toshiba was under pressure to come up with something. A tariff imposed by the federal government on Japanese portable 16-bit computers brought sales of the popular T1100 Plus to a halt. With an 8-bit data bus tied to an 80C88 processor, the T1000 comes in under the wire.

There are a few flaws: the keyboard feel is a little soft for my liking, although it does have good tactile feedback; and while its supertwist LCD is good in a well-lit room, it will cause eyestrain in less than ideal conditions.

The ROM chip supplies an old version of DOS (2.1), saving on chip space.

And of course, you sacrifice speed compared with NEC's MultiSpeed, Zenith's Z-183, and Toshiba's own T1100 Plus; the T1000 uses a 4.77-MHz 80C88 processor, giving you just PC-level performance.

Options include a 768K RAM card that can be configured as conventional memory, as EMS memory, or as a RAMdisk, to give you a possible total of 1,080K RAM. A setup utility lets you allot some of the battery's power to the RAMdisk so that, on power-down, it will retain its contents. Only 384K and only a RAMdisk can be protected for 48 hours.

Toshiba has managed to cram a serial communications port, parallel printer port, and RGB and composite video monitor connectors into the 6.4-pound T1000. Earlier, Toshiba laptops have used the same connector for external floppy disk drive and printer ports. The T1000 has separate ports, so you can use a printer and floppy disk drive at the same time. Other options from Toshiba include a 1,200-bit-per-second modem and external numeric keypad. Unfortunately, the T1000 doesn't use plug-in options designed for the T1100. And getting to the expansion slots is difficult, requiring a near-disassembly of the unit.

In short, at 6.4 pounds, the T1000 weighs less than any DOS-compatible computer around, plus it has a supertwist LCD, costs just $1,195, and is basically a fine addition to Toshiba's laptop line. The large RAM option and ROM-based DOS make up for its having only one floppy disk drive, and its light weight makes up for any other minor problems.

PC MAGAZINE FACT FILE

Toshiba T1000
Toshiba America Inc.
Information Systems Division
9740 Irvine Blvd.
Irvine, CA 92718
(714) 380-3000
List Price: $1,199; 1,200-bps modem, $399; 768K RAM card, $549
In Short: A well-made, lightweight, low-cost, PC-compatible laptop computer. Strongly recommended for its low cost and weight.

CIRCLE 431 ON READER SERVICE CARD

Microsoft Overhauls the Mouse

PC HANDS ON

BY NORA GEORGAS

What looks like a shrunken Trimline phone and fits in the palm of your hand? The new Microsoft Mouse, of course.

The smooth white mouse looks like it rolled out of a German design house—a far cry from the squat gray mice we're used to. Microsoft Corp. designers went through 100 prototypes before settling on this Bauhaus-maus with its specially positioned trackball (at the front instead of at the back of the mouse for easier movement) and slightly larger left button. It retains compatibility with current Microsoft drivers.

The new mouse skates smoothly over any surface, clicking is light and easy, and as for that look—well, let's just say I wish Microsoft would design more hardware.

List Price: Microsoft Mouse with *EasyCAD* or *Microsoft Windows*, $200

Requires: Serial mouse requires serial port; bus requires free slot. Microsoft Corp., 16011 NE 36th Way, Redmond, WA 98073; (800) 426-9400.

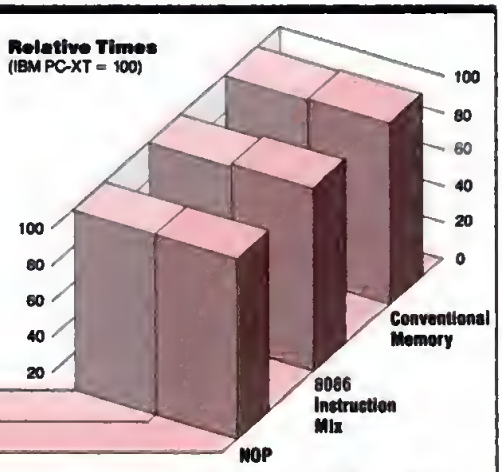
CIRCLE 445 ON READER SERVICE CARD

PC LABS Benchmark Tests: Toshiba T1000 vs. IBM PC-XT

The Toshiba T1000 runs at 4.77 MHz, far slower than the T1100 Plus, NEC MultiSpeed, and Zenith Z-183, all of which run at clock speeds of over 7 MHz. The 6.4-pound portable runs even with the IBM PC-XT on most tests.

Performance Times
(Times given in seconds)

	NOP	8086 Instruction Mix	Conventional Memory
IBM PC-XT	10.14	32.02	5 93
Toshiba T1000	10.16	32 63	5.98



The **NOP** benchmark test is designed to measure raw clock speed and memory access time while minimizing differences in microprocessors and the effect of memory caching. This test executes almost nothing but NOP ("No Operation") machine code instruction in a big 128K loop.

The **8086 Instruction Mix** benchmark test measures the time it takes to execute a selected series of processor-intensive tasks. The test program uses 8086 instruction code. These instructions are a subset of the total processor instruction set.

The **Conventional Memory** benchmark test allocates 256K bytes of conventional memory and treats it as a series of 64K-byte records, then 16,384 random records are read into and written from this memory. The result shown is the average of the read and write times.

Photograph: Thom O'Connor

32-Bit Life for PCs and XTs: A $1,495 Hauppauge 386 System Board Transplant

PC HANDS ON

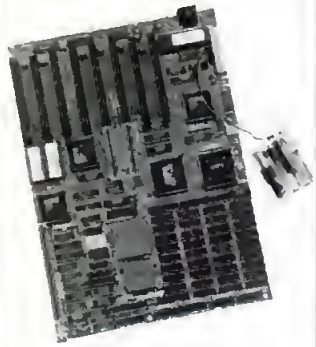
BY WINN L. ROSCH

Advancing technology hasn't just left your old XT in the dust, it's nearly buried your old machine 6 feet under. But with Hauppauge Computer Works' 386 MotherBoard you can inject a second life—in the form of 80386 performance—into the most moribund PC or XT.

The MotherBoard replaces the original IBM system board in either PCs, XTs, or computers with physically similar system boards. At $1,495 (or $1,995 with optional 80387 numeric coprocessor), about half the price of a new 80386-based PC, the upgrade can be the cheapest way to put the latest technology on your desktop.

The MotherBoard's 32-bit 80386 microprocessor runs at a full 16 MHz. Its 1 megabyte of system board memory comprises 36 DRAM chips with 4- by 64-kilobit architecture. Arranged in four banks, this memory achieves zero-wait-state operation about 75 percent of the time.

If you want to increase RAM (and you'll need several megabytes to run OS/2 when it becomes available), you won't be able to use memory cards designed for the 32-bit slots on the memory bus of Compaq's, Tandy's, or IBM's system board, so you'll have to buy expansion memory directly from Hauppauge. They offer a 4-megabyte board (with 1 megabyte installed and room for three more) for $495.



Installing the 386 MotherBoard is not difficult; only a screwdriver is required to remove the old system board after cables, expansion cards, and the power supply have been unplugged.

Two models of the 386 MotherBoard are offered, one sized to fit an XT with eight slots and another for PCs with five slots. Both models offer two 16-bit AT-style expansion connectors, one 32-bit connector for additional memory, and the balance equipped with standard eight-bit bus connectors.

Most ordinary PC and XT peripherals, including hard and floppy disk controllers, display adapters, and communications cards, work in both 386 MotherBoards because the expansion bus runs at a relatively modest 8 MHz.

In testing, the board operated perfectly with a Western Digital combined hard-and-floppy disk controller, but failed with a Scientific Micro Systems ESDI controller. Hauppauge says it's working on a fix for ESDI disks. Built into the BIOS of the 386 MotherBoard is an AT-like setup routine. As with an AT, the Hauppauge MotherBoard maintains time, date, and disk configuration information in CMOS memory kept nonvolatile by three AA batteries.

135 Watts Recommended

Overall, the Hauppauge system board consumes 30–35 watts, making it a strain on PCs equipped with 63.5-watt power supplies. Hauppauge recommends a minimum of 135 watts to run a system equipped with the board. In other words, PCs will need to have their power supplies updated to use it.

Installation is straightforward and easy. Plug and unplug a few cables, twist a couple of screws, slide in a new system board, and the processing speed of a first-generation PC climbs to double that of an AT—not bad for a 10-minute brain transplant that's well within the ability of the most technology-resistant user. PC

PC MAGAZINE FACT FILE

386 MotherBoard
Hauppauge Computer Works Inc.
358 Veterans Memorial Hwy., # M51
Commack, NY 11725
(516) 360-3827
List Price: $1,495; with 80387, $1,995.
Requires: XT or PC with upgraded power supply.
In Short: A replacement system board that upgrades PCs and XTs to 80386 features and 16-MHz near-zero-wait-state performance that's capable of using all standard eight-bit peripherals but with two 16-bit and one proprietary 32-bit slots.

CIRCLE 421 ON READER SERVICE CARD

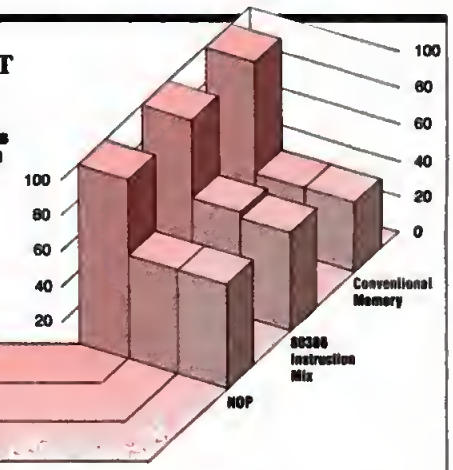
PC LABS Benchmark Tests: Hauppauge 386 MotherBoard vs. IBM PC AT with Intel Inboard/386 and IBM Personal System/2 Model 80

Hauppauge's add-in system board beats Intel's expansion card and on the 80386 Instruction Mix test, it even beats IBM's state-of-the-art Personal System/2 Model 80. That's because the Model 80 runs at one wait state and Hauppauge's board runs at zero.

Performance Times
(Times given in seconds)

	NOP	80386 Instruction Mix	Conventional Memory
IBM PC AT with Intel Inboard/386	3.68	7.64	1.60
PS/2 Model 80	2.09	4.39	0.63
Hauppauge 386 MotherBoard	2.09	4.12	0.63

Relative Times
(IBM PC AT with Intel Inboard/386 = 100)



The **NOP** benchmark test is designed to measure raw clock speed and memory access time while minimizing differences in microprocessors and the effect of memory caching. This test executes almost nothing but NOP ("No Operation") machine code instruction in a big 128K loop.

The **80386 Instruction Mix** benchmark test measures the time it takes to execute a selected series of processor-intensive tasks. The test program uses 80386 instruction code. These instructions are a subset of the total processor instruction set.

The **Conventional Memory** benchmark test allocates 256K bytes of conventional memory and treats it as a series of 64K-byte records. Then, 16,384 random records are read into and written from this memory. The result shown is the average of the read and write times.

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Informix Plugs a Vast Relational Database Manager into 1-2-3

PC HANDS ON

BY JOE BENDERAVAGE

It's a harmonious marriage for *Informix Datasheet Add-In*, a new database management system, and Lotus's *1-2-3*. Together they become a true relational database, capable of joining multiple tables, extracting their information, and performing up to eight sorts at once. And it's a modern marriage, too: worksheets remain relatively free, permitting you to modify, add to, and delete from vast quantities of centralized, indexed, and uncorrupted data.

Informix is the first company to take advantage of the add-in facility in Lotus's *1-2-3*, Release 2. *x*, in order to produce a fully featured DBMS. The company is known for its heavy-hitting programmable relational database, *Informix-SQL*.

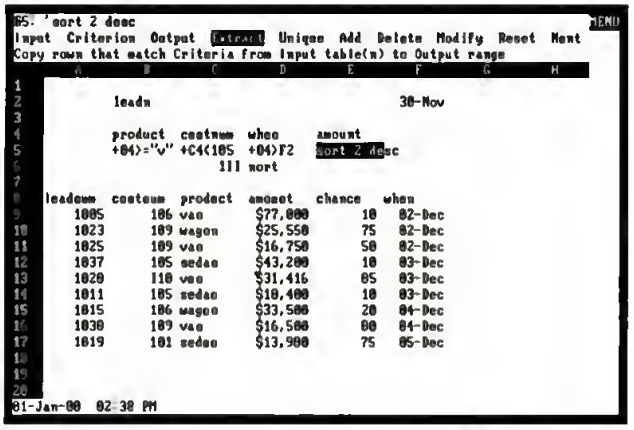
One small limitation in *Datasheet* that you'll need to be aware of: data input is case sensitive. And there's no provision for the kind of entry screens you get with programs like *KnowledgeMan*.

But *Datasheet* is an easy program to use. Some of its prompts have slightly different wording than is shown in the manual's illustrations, but the meanings are basically clear.

There are several unexpected nice touches: during Modify operations from the *Datasheet* menu, one cell can hold both formulas and functions; aggregate functions can simplify graphics and statistical presentations; and table structure can be changed anytime. Paging options tally cumulative subtotals and totals and evince them on succeeding screens.

You can find applications in *Datasheet* for *1-2-3* macros; these can convert *1-2-3* databases to *Datasheet* database tables as well. *Datasheet* can link to *Informix-SQL* and *Informix-4GL*. It can also serve as a relational database on its own.

Considering all of this muscle, a price tag of $199.95, high when compared with other Lotus add-ins, is not unreasonable.



Informix Datasheet Add-In's operations work seamlessly from within Lotus's 1-2-3; *in fact, its menu has many of the same functions as* 1-2-3*'s Data options. Above, Extract pulled data according to a formula entered in the spreadsheet.*

PC MAGAZINE FACT FILE

Informix Datasheet Add-In
Informix Software Inc.
4100 Bohannon Dr.
Menlo Park, CA 94025
(415) 322-4100
List Price: $199.95
Requires: 640K RAM; 1-Mbyte hard disk drive; *1-2-3*, Release 2.0 or later; DOS 2.11 or later.
In Short: Here's the vast database capacity that *1-2-3* has lacked. Not copy protected.

CIRCLE 424 ON READER SERVICE CARD

Spreadsheets in the Field: $99 Liberty Compiles 1-2-3 Models

PC HANDS ON

BY JARED TAYLOR

@Liberty is a wonderful idea. It turns a spreadsheet model into a standalone program that can run all by itself. After you process a model with *@Liberty*, you can pass it along to coworkers who can enter data, and print results without even owning a spreadsheet program. *@Liberty*'s big limitations are that it essentially supports only *1-2-3*, Release 1A functions and cannot run many complex macros. It also recalcs very slowly.

@Liberty is made up of two programs. The first is PREPARE.EXE, which converts, or "compiles," your worksheet model.

To execute your compiled model you need the other program, RUN.EXE. When RUN brings up your model it looks exactly like a spreadsheet, but there are very important differences. You can change only those cells that you specifically unprotected in the precompiled worksheet. Formulas can't be changed, or even displayed, whether you unprotected them or not. This prevents tampering.

Moreover, RUN doesn't have most of the worksheet-building commands like Copy, Move, Format, Erase, or Column Width. This means that in RUN you can change input values and do recalculations, but you can't change the model in any important way.

This is fine for model developers who don't want users messing with anything, but it also means that any macros that use worksheet-building commands won't work. Unfortunately, many other useful things won't work either: string functions, many date and time functions, /X macro commands, and @cellpointer. PREPARE detects unsupported @ functions and warns you about them, but it can't warn you about macros that won't work. Also, be prepared for slow recalcs. It took 11 minutes for *@Liberty* to do a job *1-2-3* does in 90 seconds.

If the models you build aren't very sophisticated, or you have simple worksheets you need to have filled with data, *@Liberty* could be a good way to spread the work around.

PC MAGAZINE FACT FILE

@Liberty
SoftLogic Solutions Inc.
One Perimeter Rd.
Manchester, NH 03103
(800) 272-9900
(603) 627-9900
List Price: $99.95
Requires: 256K RAM, one disk drive, DOS 2.0 or later.
In Short: A program that "compiles" *1-2-3* and compatible spreadsheet models to run as standalone applications without *1-2-3*. Not copy protected

CIRCLE 425 ON READER SERVICE CARD

How Better Writing Can Make You A Happy Camper.

Meet George. George is a bright guy. He got an IBM PC to help get his work done faster so be could spend more time with the kids. He got word processing software with a spelling checker to help him write better. Then be got mad. Because the computer works but his writing doesn't: word processing makes it easier to write bad. Fast.

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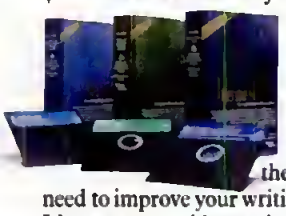

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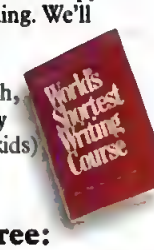

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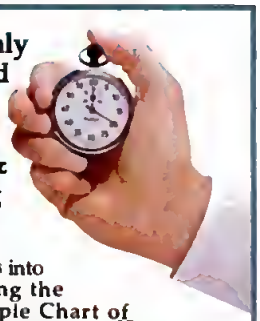

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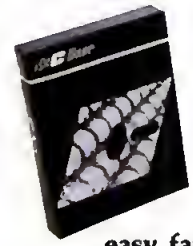

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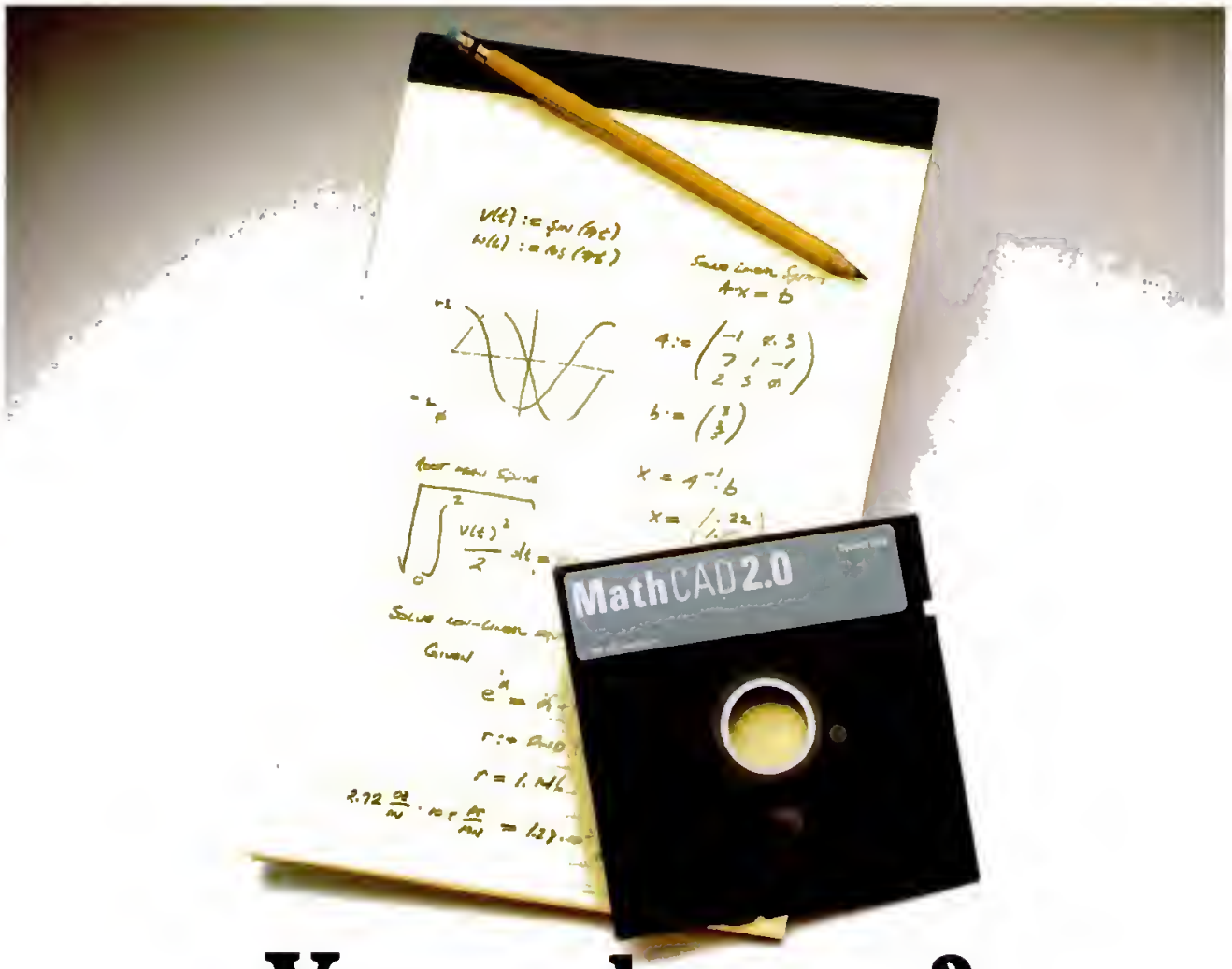

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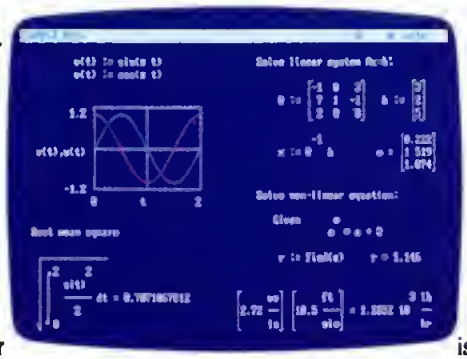

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CIRCLE 154 ON READER SERVICE CARD

Communications Programs: Boyan Builds In Shortcuts, Freeway Presents Roadblocks

PC HANDS ON

BY EDWARD MENDELSON

Two communications programs turned up recently at *PC Magazine*, and they arrived in very different ways. One of them, *Freeway Advanced*, came in a glossy package and was heralded by a thundering ad campaign. The other, *Bayan*, slipped in unobtrusively on a floppy disk, with a manual that we had to print out ourselves from a disk file. The quieter arrival was the more significant one. *Boyan*'s innovative features and its elegant and intuitive interface combine to make it one of the finest communications programs available for personal use.

Bayan does more than any other program to ease the tedium and repetitiveness of telecommunications. The 200-entry dialing directory stores a default transfer protocol for each phone number, so you can use ASCII uploads to MCI Mail, or Xmodem or Ymodem to a BBS, without specifying the protocol each time. When you transfer a file, *Bayan* doesn't make you type the name twice. It reads the screen for the filename that you typed the first time and puts it on a menu for you to accept or alter. *Boyan*'s algorithm seems to find the right filename 99 times out of a hundred. When it's wrong, you type in the name you intended.

Macros let you redefine the function keys for almost any purpose you can imagine. You can open log files, toggle between different dialing prefixes for home or office, transmit your password, or anything else. The script language includes dozens of ingenious shortcuts.

One keystroke takes you to a scroll-back buffer that lets you review everything displayed on-screen since the start of a session.

Most standard protocols are built in, and *Boyan* is designed so that any other protocol, such as Zmodem, *Kermit*, or *Megalink*, can be added via external programs available on most BBSs.

Missing are a host mode and terminal emulation. But *Bayan* does everything else and does it brilliantly well.

Yet *Boyan* is the work of a high school student who wrote it to pay for his college education. If this is the program he wrote to pay for college, what will he do when he goes on to graduate school?

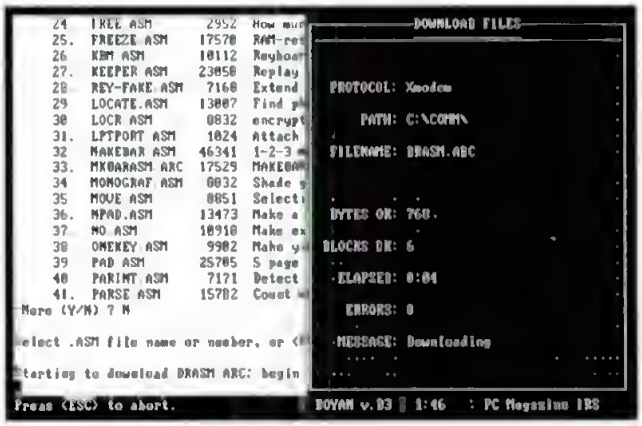
The manual calls it "the best communication software," and the list of features makes it sound like the road to modem paradise. *Freeway Advanced*, from Kortek Inc., combines menus for novices, scripts for experts, customizable settings, keystroke playback, *Crasstalk* command emulation, terminal emulation, host mode, and even an on-line editor for preparing messages before sending them. Yet despite all this, *Freeway Advanced* perhaps should have been named *Dirt Road Rudimentary*.

You bump into *Freeway*'s first roadblock when you attempt the teeth-gnashingly complicated process of adding an entry to the dialing directory. The program doesn't guide you through the necessary items but makes you select each in turn from a menu. If you want to change an entry, you have to remember to choose the menu item that confirms your changes. More streamlined programs accept your changes unless you specifically cancel them. You can't attach long-distance phone numbers and access codes to entries outside your local area; if you specify a dialing prefix, it applies to every number you call.

The 100-entry dialing directory occupies ten separate files with ten entries each, and you have to stumble through menus to get from one file to the next. You have to retype an entry if you want to move it from one file to another. You can use highlighted letters or the cursor keys to select menu items, but if you change a menu entry, the highlighted letters associated with other items tend to change also, blocking off all possible shortcuts.

Freeway takes up to 30 seconds to recognize a busy signal. When you finally get through to a number, the screen changes to black and white and all menus disappear. You have to hit another key to access a new menu before you can download or upload or simply hang up. The program doesn't include a chat mode, which divides the screen for "conversation" with a remote computer. At least you can use a learning mode that will play back your keystrokes—*very* slowly—the next time that you connect to the same phone number.

Not everything on the *Freeway* is bumpy. The program has uncommon features like multiple filters for incoming text, a pop-up editor for your messages, and a command to alert you when your call exceeds a certain length of time. It also displays a giant digital clock, which you can turn off if you don't like to think about the time you're wasting. PC



Boyan *reads the screen to find the name of the file you want to send or receive. You can set a default transfer protocol for each number you call.*

PC MAGAZINE FACT FILE

***Boyan*, Version D3**
Justin Boyan
9458 Two Hills Ct.
Columbia, MD 21045
(301) 495-7323 (BBS number)
List Price: $45 for disk and registration; $35 registration fee for copies downloaded as shareware from a BBS.
Requires: 192K RAM, one disk drive, DOS 2.0 or later.
In Short: A superb communications program with an elegant interface and unique conveniences. Not copy protected.

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***Freeway Advanced*, Version 2.1**
Kortek Inc.
505 Hamilton Ave.
Palo Alto, CA 94301
(800) 327-0310
(415) 327-4555
List Price: $89.95; version without host mode and other features, $24.95.
Requires: 300K RAM, one disk drive, DOS 2.0 or later.
In Short: Clumsy communications program with the biggest digital clock you ever saw. Not copy protected.

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QUICK LOOKS

VS Tool Kit Has Painless Font Control

PC HANDS ON

BY EDWARD MENDELSON

One reason it's called desktop publishing is that you get frustrated and annoyed and spend a lot of time banging your head on the desktop. Soft fonts are one of the worst dangers to your cranium. No word processing package offers a straightforward way to use sets of fonts that you select on your own.

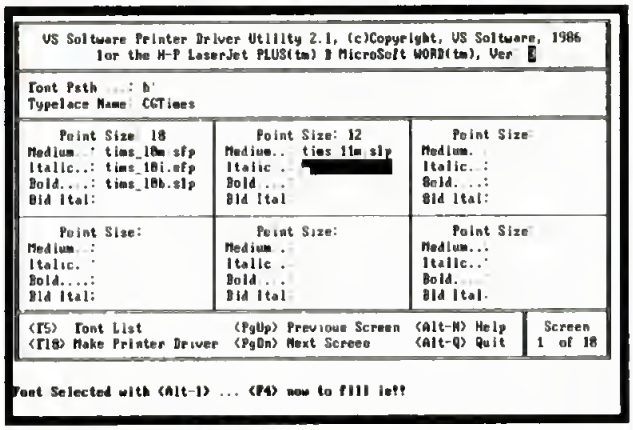
VS Software's *VS Tool Kit* protects your aching forehead by automating the details of font management. You can put together any combination of soft fonts, from any source, and let the program generate the files you need for keeping track of them. If you use *WordPerfect* or *Microsoft Word*, the program makes your life even easier by creating custom print drivers for any set of fonts that you choose.

With *WordPerfect* your new font set is added to the printer driver you already use. With *Word* you get a text file that *Word* will change into a printer driver. A utility in the package converts portrait fonts to landscape fonts and back again.

You get the program as a bonus when you buy VS Software's soft fonts, *FontGen IV Plus* font editor, or *SLEd* signature/logo editor. You can also buy it as a separate package for $149.95. That isn't cheap, but the convenience it provides will help soothe your forehead.

List Price: *VS Tool Kit*, $149.95. **Requires:** 512K RAM; one disk drive; Hewlett-Packard, Cordata, Ricoh, or Canon laser printer with downloading capability; DOS 2.0 or later. Not copy protected. VS Software, 209 W. Second St., P.O. Box 6158, Little Rock, AR 72201; (501) 376-2083.

CIRCLE **428** ON READER SERVICE CARD



VS Tool Kit's *one inconvenience is that you must type out long font filenames.*

IndexAid Eases Your Indexing Chores

PC HANDS ON

BY CATHERINE D. MILLER

One of the most dreaded parts of producing any publication—whether it be a manual or a product catalog—is putting together an index. Not only do you have to go over your manuscript to pick out the entries, but you also have to sort the entries into an easily accessible index.

IndexAid, from Santa Barbara Software Products, takes some of the tedium out of index preparation. And it produces a professional index that follows the rules of indexing.

Many word processing programs (for example, *WordPerfect*, *XyWrite III*, and *WordStar Professional*) can generate an index that alphabetically lists principal words. But you still need to spend a lot of time editing the resulting concordance to provide the transpositions and cross-references that make a truly useful index. *IndexAid* does all this for you.

IndexAid is menu driven, but it's not intuitive. You generate an index by first typing in topics and page numbers. A style checker helps you weed out inconsistencies, a sorter imposes organization, and a formatter gets it ready for the printer.

The program is powerful and a great help in index preparation, but the screens are crowded and unattractive.

Although *IndexAid* will help you produce a professional index, you still have to comb through your manuscript to pick items to be included in the index, but the resulting work will certainly be more polished.

List Price: *IndexAid*, Version 2, $99 plus $5 shipping. **Requires:** 256K RAM, two disk drives, DOS 2.0 or later. Copy protected. Santa Barbara Software Products, 1400 Dover Rd., Santa Barbara, CA 93103; (805) 963-4886.

CIRCLE **429** ON READER SERVICE CARD

How to Take Software for a Test Drive

PC HANDS ON

BY GUS VENDITTO

Here's news: someone's hit upon a valid use for copy protection.

It's a software sampler for people who don't spend hours in showrooms test-driving the applications and utilities on their wish list. It's sold under the name of *pSee* and is being marketed by pSee Software Promotions as a bimonthly subscription: six issues for $125, with a trial issue going for $25 (applicable toward the yearly subscription). The criteria by which *pSee* must be judged is whether you've considered buying the programs in the sampler.

The first issue is promising; all ten programs may have piqued your interest but aren't crucial applications. Things like *SQZ!*, the worksheet condenser; *Bookmark*, which saves an image of current RAM to disk; *Q-DOS II*, the DOS shell; and *Electric Webster*, the on-line dictionary; plus *Back-it*, *Menu Manager*, *jot!*, *Pop Drop*, *Whoops!*, and *Note-It*.

These aren't demos; they're the full program with a built-in hook: six or so runs and you're down for the count.

It's not a perfect implementation. pSee's cast-iron copy-protection scheme is fooled by disk caches and will conflict with many copy-protected programs. But if you're willing to flush out your system for a tour of some prospective programs, *pSee* could save you from a big investment in shelfware.

List Price: *pSee*, one copy, $25; six-issue subscription, $125. **Requires:** 256K RAM, DOS 3.1 or later. Copy protected. pSee Software Promotions, 25 Drydock Ave., Boston, MA 02210; (800) 461-1991.

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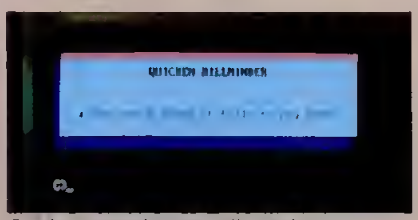

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your bills, print your checks, and update all records automatically. All you do is sign the checks.

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Here's what the critics say:

"I've never seen such an easy-to-use manual or software that's so simple to use." *Martin Blumenthal, inCider Magazine*

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CIRCLE 151 ON READER SERVICE CARD

$350 Boeing Graph Brings EGA Color to 3-D Perspective Charts

PC HANDS ON

BY MITT JONES

A year ago, Three D Graphics unveiled *Perspective*, an elegant three-dimensional graphics package that wowed users despite its use of only monochrome displays and black-and-white printers. It brought true 3-D graphics, using *x*, *y*, and *z* axes (not mere shading), to presentations.

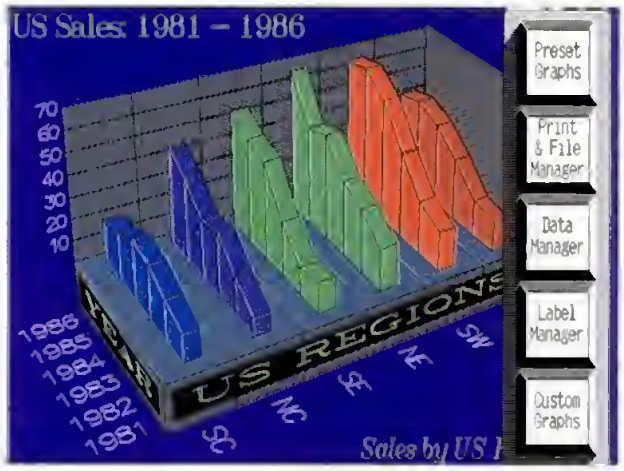
Now *Perspective* has reemerged as *Boeing Graph*, a collaboration between Three D Graphics and Boeing Computer Services. *Boeing Graph* retains the basic feel and elegance of its predecessor, which is no longer available. But several enhancements, including an EGA display of 64 16-color palettes, render *Perspective* a relic of the past.

The first step in creating a graph is to enter, import, or edit your figures using the Data Manager. The Data Manager centers around a three-dimensional spreadsheet that permits up to 15,000 each of rows, columns, and pages. You can import .WKS, .WK1, .SYLK, .DIF, ASCII, and .ASC (*Boeing Calc*) files with only a few keystrokes.

From there, you choose among 16 two-dimensional or 33 three-dimensional graph types; a Custom Graphs option permits you to try out different colors, shading patterns, graph labels, and viewing angles.

Boeing Graph allows stacked 3-D charts, so you can graph more than one page of a spreadsheet. Output-device support accommodates most laser, dot matrix, and color ink jet printers.

You'll have to wait for Version 4.0, due out in mid-October, for plotter drivers such as HPGL.



Boeing Graph*'s function-key menu displays over the current graph, which is a true three-dimensional representation. The Spacebar toggles the menu on and off, and the cursor keys move the menu about the screen.*

PC MAGAZINE FACT FILE

***Boeing Graph*, Version 2.0**
Boeing Computer Services
P.O. Box 24346, MS7W-05
Seattle, WA 98124
(800) 368-4555
List Price: $350; $95 upgrade for owners of *Perspective*.
Requires: 512K RAM, hard disk drive, EGA with 256K video RAM, DOS 2.0 or later.
In Short: A power-packed 3-D graphics package that is fairly easy to use and produces magnificent results. Not copy protected.

CIRCLE 443 ON READER SERVICE CARD

Aside from the lack of plotter and slide-maker support, my only major complaint with *Boeing Graph* is its complicated menu structure, which sometimes makes it easy to forget where you are and where to find what you need.

Version 2.0 supports only EGA systems, inexplicably leaving out *Perspective*'s Hercules support. However, Version 4.0 (there will be no Version 3.0) will include the Hercules support and add CGA support in the bargain. PC

Turbo Solutions: Magic from a Master

PC BOOK REVIEW

BY CATHERINE D. MILLER

Libraries of Turbo Pascal routines abound, in both software and book format. In *Turbo Pascal Solutions*, Jeff Duntemann takes a different approach. While providing you with the routines you expect from this kind of work, he gives you the theory behind the routines—the nuts and bolts of how the IBM PC version of Turbo Pascal works with your machine.

Duntemann starts with elementary concepts that urge you to organize your disks and programs. He then shows you how you can customize Turbo Pascal working with DOS DEBUG.

After the PC fundamentals—interrupts, registers, ROM BIOS services, the 8087/80287—are discussed in relation to Turbo Pascal, you're prepared to take on the assembly language interface.

Duntemann discusses the two ways to use machine code from within Turbo Pascal—the Turbo Pascal Inline statement and external machine-code routines. You'll find functions and procedures to illustrate many of these principles.

Text video is covered in depth. Duntemann explains how to write characters directly to the RAM buffers of your display card (and thereby bypass the slow ROM BIOS) by using DMA (direct memory access).

Many routines included in this book are useful as well as instructive. VECTORS.PAS allows you to inspect and change 8086 interrupt vectors. GAMEBORD.ASM is an assembly language joystick support subprogram, called from Turbo Pascal, that also shows you how to combine several assembly language source files into a single machine-code module.

Duntemann's writing style is eminently readable, and the book is brimming with examples, diagrams, and useful routines. When you've finished going through *Turbo Pascal Solutions*, you'll have the necessary knowledge to start creating your own Turbo Pascal toolboxes. PC

PC MAGAZINE FACT FILE

Turbo Pascal Solutions
By Jeff Duntemann
Scott, Foresman & Co.
1900 E. Lake Ave.
Glenview, IL 60025
(312) 729-3000
ISBN: 0-673-18584-2
Copyright: 1987
List Price: $21.95
In Short: This well-written book by an authority on Turbo Pascal does a great job of covering Turbo Pascal's low-level interface to the PC.

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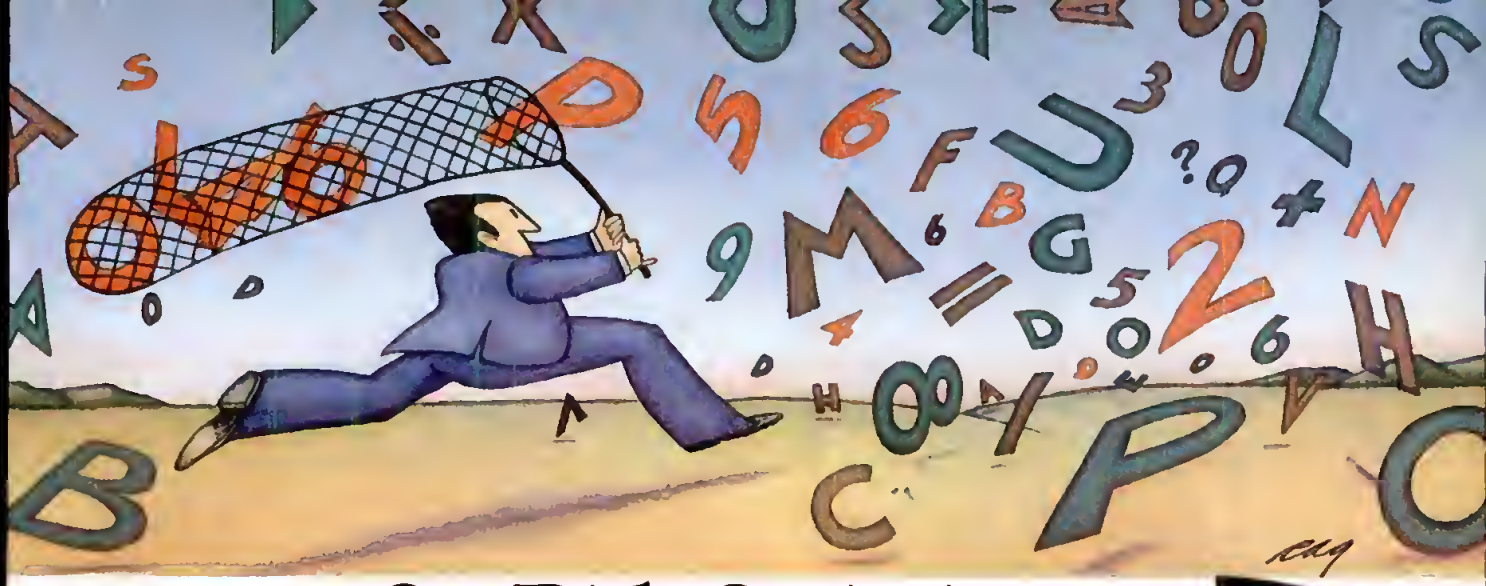

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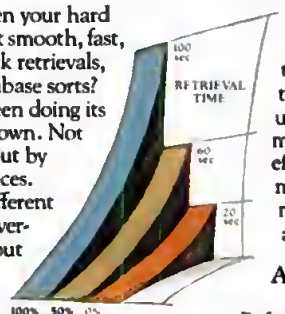

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-Stephen R. Davis, PC MAGAZINE

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CIRCLE 123 ON READER SERVICE CARD

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NEW ON THE MARKET

3-D Spreadsheets Let Users Link Worksheets

While Lotus and the *1-2-3* clone makers slug it out in the courts, two software companies are taking spreadsheets to a new dimension. *Surpass* ($495), from **Surpass Software Systems**, and *Lucid 3-D* ($199), from **Personal Computer Support Group**, let users link multiple spreadsheets. That means that complex models can be constructed more easily, because each component can be contained in its own spreadsheet. And when a worksheet is updated, linked worksheets are automatically updated as well.

Surpass spreadsheets can be viewed in windows, so the effect of a change in one spreadsheet on linked spreadsheets can be instantly seen. Macros created on a single spreadsheet can operate on all linked worksheets.

Surpass offers background recalculation, which allows the user to continue working while recalculation proceeds. Dependency-based recalculation ensures that only cells related to user changes are recalculated.

Lucid 3-D also supports background and dependency-based recalculation. The program can be run as a memory-resident application and requires only 75K bytes for program code. Despite its background operation, *Lucid 3-D* supports most of *1-2-3*'s spreadsheet features while adding numerous features of its own.

When memory resident, *Lucid 3-D* has considerable capabilities for cutting and pasting between spreadsheets and foreground applications.

List Price: *Surpass*, $495.
Requires: 512K RAM, DOS 2.0 or later. Not copy protected. Surpass Software Systems Inc., 14 Commercial Blvd., #131, Novato, CA 94949; (415) 382-8840.

CIRCLE **434** ON READER SERVICE CARD

List Price: *Lucid 3-D*, $199.
Requires: 256K RAM, DOS 2.0 or later. Not copy protected. Personal Computer Support Group, 11035 Harry Hines Blvd., Bldg. 207, Dallas, TX 75229; (214) 351-0564.

CIRCLE **435** ON READER SERVICE CARD

HP's Portable Vectra CS Has 1.44-Meg Drives, Four Proprietary Expansion Slots

Portable computers with desktop power have brought DOS onto airplanes and into the field. **Hewlett-Packard Co.** hopes to interest the growing number of mobile power users in its HP Portable Vectra CS. It has an 8086-compatible CMOS microprocessor and runs for up to 10 hours on a single battery charge. A battery "fuel" gauge alerts users to low battery power while there is still time to back up files.

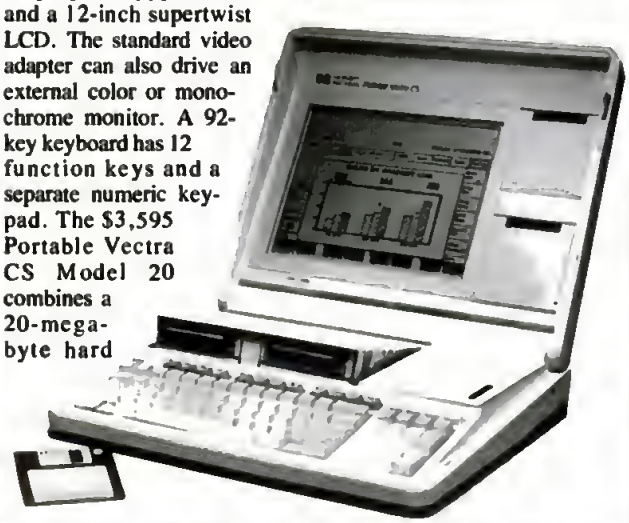
At 13.9 by 16.6 by 3.5 inches (LWH) and 17.6 lbs., the system is bigger than most laptops but well within the portable realm.

The $2,495 Portable Vectra CS comes with 640K bytes of RAM; two 3½-inch, 1.44-megabyte floppy disk drives; and a 12-inch supertwist LCD. The standard video adapter can also drive an external color or monochrome monitor. A 92-key keyboard has 12 function keys and a separate numeric keypad. The $3,595 Portable Vectra CS Model 20 combines a 20-megabyte hard disk with a single floppy disk drive.

Four proprietary expansion slots accept optional add-in cards. HP offers an EMS adapter ($1,795 for 2 megabytes, $995 for 1 megabyte, and $220 unpopulated) that has two serial ports. Two modems (2,400-bit-per-second, $695; 1,200-bps, $450) are also available for the Portable Vectra CS expansion bus.

List Price: HP Portable Vectra CS, $2,495; HP Portable Vectra CS Model 20, $3,595; EMS adapter, $1,795 with 2 megabytes; 2,400-bps modem, $695; 1,200-bps modem, $450. Contact the Hewlett-Packard Co. sales office at (800) 367-4772.

CIRCLE **433** ON READER SERVICE CARD



The $2,495 HP Portable Vectra CS has two 1.44-megabyte, 3½-inch floppy disk drives as standard equipment. Its LCD screen delivers resolution of 640 by 400.

The compact Co-Pilot 140 backup system ($1,495) can run your AT for 2 hours during a power failure, according to Applied Research and Technology.

Co-Pilot Backup Power System Furnishes 2 Hours of Energy to AT

Backup power systems are often physically cumbersome and may only supply a few minutes of grace for your open files during a power outage. The Co-Pilot 140, from **Applied Research and Technology**, could change all that. Applied Research says the compact unit can supply up to 2 full hours of backup power for a fully loaded AT. The $1,495 unit measures 16 by 14.5 by 2.7 inches (LWH) and weighs 35 pounds. It can sit between the computer and monitor.

Unlike current UPS (universal power systems) or SPS (standby power systems) backups, the Co-Pilot 140 is based on continuous parallel power technology. It feeds DC power directly to the computer at the output side of the computer's power supply, so the computer has two DC power sources available at all times.

If voltage from the PC's power supply drops below the voltage provided by the Co-Pilot 140, the computer automatically begins to draw power from the higher-voltage source.

The Co-Pilot 140 also provides EMI/RFI and surge/spike protection, according to Applied Research.

List Price: Co-Pilot 140, $1,495. Applied Research and Technology Inc., The Pavilion, #201, 5770 Powers Ferry Rd., N.W., Atlanta, GA 30327; (404) 951-9556.

CIRCLE **436** ON READER SERVICE CARD

by Jonathan Matzkin

Mitsubishi Electronics' $685 Model XC-1429C monitor is an alternative to IBM's PS/2 compatible onolog display monitors. It provides resolution of up to 640 by 480 pixels. The monitar has a horizontal-scanning frequency of 31.5 kHz ond o vertical-sconning frequency of 60 or 70 Hz.

Mitsubishi VGA Display Offers an Alternative to The IBM PS/2 Monitors

Mitsubishi Electronics Amerlca has introduced a VGA-compatible analog display monitor with a .28-mm dot pitch and resolution of up to 640 by 480 pixels. The fixed-frequency Mitsubishi Model XC-1429C ($685) has a horizontal-scanning frequency of 31.5 kHz and a vertical-scanning frequency of 60 or 70 Hz.

List Price: Mitsubishi Model XC-1429C, $685.

Requires: VGA or compatible graphics adapter. Mitsubishi Electronics America Inc., Computer Peripherals Division, 991 Knox St., Torrance, CA 90502; (213) 515-3993.

CIRCLE **438** ON READER SERVICE CARD

HOT PROSPECT

Microsoft Multifunction Add-in Card Is Bridge to OS/2 for 8088 PCs

Microsoft Corp. bas announced the Mach 20, a multifunction upgrade board that prepares the bumble, 8088-based PC for a new life in the post-DOS world.

The $495 Macb 20 is an 80286 enhancement card with interfaces for memory expansion, for a disk drive controller, and for grapbics input devices. The on-board 80286 CPU runs at 8 MHz and replaces the host PC's original 8088. The Mach 20 also bas a 16K-byte memory cache to optimize system performance.

Tbe Mach 20's Memory Plus option ($495 with 512K bytes of RAM) supports up to 3.5 megabytes of expanded memory. This allows PCs to run MS OS/2, which requires a minimum of 1.5 megabytes. Microsoft will make available a custom version of MS OS/2 (price as yet undetermined) for the Memory Plus option. This will guarantee compatibility with OS/2 applications, according to Microsoft.

Tbe Memory Plus option also includes a driver that supports the LIM 4.0 memory management specification.

An optional Disk Plus daughterboard ($99) plugs into a connector on the Mach 20 and replaces the PC's standard floppy disk controller. The Disk Plus controller supports internal 5¼-inch floppy disk drives with 1.2-megabyte or 360K-byte capacities, as well as 1.44-megabyte and 720K-byte internal 3½-inch floppy disk drives.

The Macb 20 has an inport interface with a 9-pin circular connector that supports the Microsoft mouse and other inport-equipped input devices.

List Price: Mach 20, $495; Memory Plus option with 512K, $395; Disk Plus option, $99.

Requires: 8088-based PC, one expansion slot. Microsoft Corp., 16011 NE 36th Way, P.O. Box 97017, Redmond, WA 98073; (206) 882-8080.

CIRCLE **432** ON READER SERVICE CARD

8088-based PCs may find some new life with Microsoft's $495 Moch 20. The board features the memory and 80286 microprocessor that are required to run Microsoft's OS/2.

D.A.V.E. 1-2-3 Add-in Creates Custom Data Forms for Worksheets

Goldata Computer Services has added *D.A.V.E.* (Data Addition, Verification, and Editing) to the growing number of add-ins that run under *1-2-3*. The $99 program lets you create customized data entry forms for *1-2-3* worksheets. Forms are created by simply painting the image on the screen and specifying editing criteria for each input field.

Images can be up to ten pages in length and can have up to 256 fields. A Verify option checks existing *1-2-3* worksheets for edit violations based on edit criteria set up by the user.

List Price: *D.A.V.E.*, $99.

Requires: 64K RAM; *1-2-3*, Release 2.0 or later; DOS 2.0 or later. Not copy protected. Goldata Computer Services Inc., 2 Bryn Mawr Ave., Bryn Mawr, PA 19010; (215) 525-1036.

CIRCLE **440** ON READER SERVICE CARD

LAN Uses a Token-Ring Topology and Has Plug Compatibility with IBM

Gateway Communlcations has introduced a local area network that is plug compatible with the IBM Token-Ring Network. G/Token-Ring is an IEEE 802.5 IBM Token-Ring–compatible, baseband LAN. IBM boards and G/Token-Ring boards can coexist on the same network cable.

The network employs a ring topology, in which workstations are attached to central office hubs called multistation access units. The multistation access units are daisy-chained together throughout the system. Network nodes may be as far as 150 feet from office multistation access units. The network operates at 4 megabits per second over twisted-pair cabling. The system supports *NetWare* or any NETBIOS-based operating system. Gateway says the system can access virtually all the multiuser network software available today. A system with *Advanced NetWare/86*, a four-node multistation access unit, and a two-node starter kit sells for $2,995.

List Price: G/Token-Ring with *Advanced NetWare/86*, four-node multistation access unit, and two-node starter kit, $2,995. With three-node starter kit and eight-node multistation access unit, $4,540. Individual G/Token-Ring network adapter card, including 8-foot cable, $650. Gateway Communications Inc., 2941 Alton Ave., Irvine CA 92714; (800) 367-6555.

CIRCLE **439** ON READER SERVICE CARD

PC UPDATE

edited by Peggy Gavan

Microsoft Word, Version 4.0

Microsoft Word, Version 4.0, has been enhanced for speed; Microsoft Corp. claims an improvement of up to five times in character mode and two times in graphics mode. The new version also adds a document management and retrieval system and powerful macro-processing capabilities. In addition, *Word* 4.0 offers a toggle switch between character mode and graphics mode, adds a redlining feature, and supports line drawing, boxing, and bordering. The retail price of Version 4.0 remains at $450. Registered users of *Word* 3.*x* can upgrade for $75. Microsoft Corp., Redmond, Wash.; (206) 882-8080.

Word, *Version 4.0, adds a document management and retrieval feature and macro-processing capabilities.*

Paradise Systems' AutoSwitch, Basic EGA

Paradise Systems has reduced by up to 28 percent the price of three EGA cards. The **AutoSwitch EGA-480**, originally priced at $479, dropped $130 to $349. The **AutoSwitch EGA-350** and **Basic EGA**, previously priced at $349 and $249, respectively, were both reduced $50. Paradise Systems Inc., South San Francisco, Calif.; (415) 588-6000.

Moniterm Professional Mouse

Logitech's new 320-dot-per-inch-resolution mouse is available for use with Moniterm Corp.'s 19-inch monitors. The three-button mouse, called the **Moniterm Professional Mouse**, supports Moniterm's high-resolution displays—the Viking I, Viking 10, and Viking Portrait monitors. The mouse is priced at $250. Moniterm Corp., Minnetonka, Minn.; (612) 935-4151.

PC-Write

Quicksoft's *PC-Write* now has a package for DCA file conversion, enabling you to transfer documents between *PC-Write* and other word processing programs or IBM mainframes. The complete package, which includes software and the Conversion Guide, has a $29 shareware registration fee. Quicksoft, Seattle, Wash.; (206) 282-0452.

KB5153 Touch-Pad Keyboard, Release 3.0

Key Tronic Corp. has enhanced its **KB5153 Touch-Pad Keyboard** by adding built-in software drivers to support desktop publishing software programs such as *PageMaker* (PC version), *Ventura Publisher*, and *Harvard Professional Publisher*. In addition, the new release comes with mylar templates to aid in desktop publishing projects. Registered users can upgrade to Release 3.0, priced at $399, for $29. Key Tronic Corp., Spokane, Wash.; (800) 262-6006.

Key Tronic's enhanced KB5153 Touch-Pad Keyboard now supports desktop publishing software programs such as PageMaker.

PC Paintbrush For Windows

Z-Soft Corp. has announced a new version of *PC Paintbrush* that's designed to run under *Microsoft Windows*. With *PC Paintbrush for Windows*, you can edit two different pictures simultaneously or edit a picture in one window while editing text in another. The new version, priced at $84, runs in color or monochrome and is compatible with all hardware designed to run under *Windows*. Upgrades are $35 for registered users. Z-Soft Corp., Marietta, Ga.; (404) 980-1950.

IN BRIEF

Squish, Version 1.3, has enhanced batch file support and can compress large files on disks filled to capacity. Registered users of *Squish* can upgrade to Version 1.3 ($79) for $15. Sun-Dog Software, Brooklyn, N.Y.; (718) 855-9141 . . . ***Timeslips***, Version 3.1, an enhanced version of *Timeslips*, has an expanded description field, shorthand macros, and a custom report generator. Registered users of *Timeslips* can upgrade to Version 3.1 for $99.95. Upgrades are $30 for users of Version 3.0. North Edge Software Corp., Essex, Mass.; (617) 468-7358.

PS/2 WATCH

Lotus's HAL

Lotus Development Corp. has released a new version of ***HAL*** for PS/2 users. The new version takes advantage of DOS 3.3 and VGA display modes. Lotus will begin an exchange program in October that will require a $30 upgrade charge; call (617) 623-5680 for details.

Borland's new Turbo C: The most powerful optimizing compiler ever

Our new Turbo C* generates fast, tight, production-quality code at compilation speeds of more than 13,000* lines a minute!

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Michael Abrash, Programmer's Journal

Join more than 100,000 Turbo C enthusiasts. Get your copy of Turbo C today!

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CIRCLE 137 ON READER SERVICE CARD

Technical Specifications

- *Compiler: One-pass optimizing compiler generating linkable object modules. Included is Borland's high-performance Turbo Linker.™ The object module is compatible with the PC-DOS linker. Supports tiny, small, compact, medium, large, and huge memory model libraries. Can mix models with near and far pointers. Includes floating point emulator (utilizes 8087/80287 if installed).*
- *Interactive Editor: The system includes a powerful, interactive full-screen text editor. If the compiler detects an error, the editor automatically positions the cursor appropriately in the source code.*
- *Development Environment: A powerful "Make" is included so that managing Turbo C program development is highly efficient. Also includes pull-down menus and windows.*
- *Links with relocatable object modules created using Borland's Turbo Prolog® into a single program.*
- *Inline assembly code.*
- *Loop optimizations.*
- *Register variables.*
- *ANSI C compatible.*
- *Start-up routine source code included.*
- *Both command line and integrated environment versions included.*
- *License to the source code for Run-time Library available.*

Sieve benchmark

	Turbo C	Microsoft® C
Compile time	*2.4*	13.51
Compile and link time	*4.1*	18.13
Execution time	*3.95*	5.93
Object code size	*239*	249
Execution size	*5748*	7136
Price	*$99.95*	$450.00

*Benchmark run on an IBM PS/2 Model 60 using Turbo C version 1.0 and the Turbo Linker version 1.0; Microsoft C version 4.0 and the MS overlay linker version 3.51

Minimum system requirements: IBM PC, XT, AT, PS/2 and true compatibles. PC-DOS (MS-DOS) 2.0 or later. 384K.

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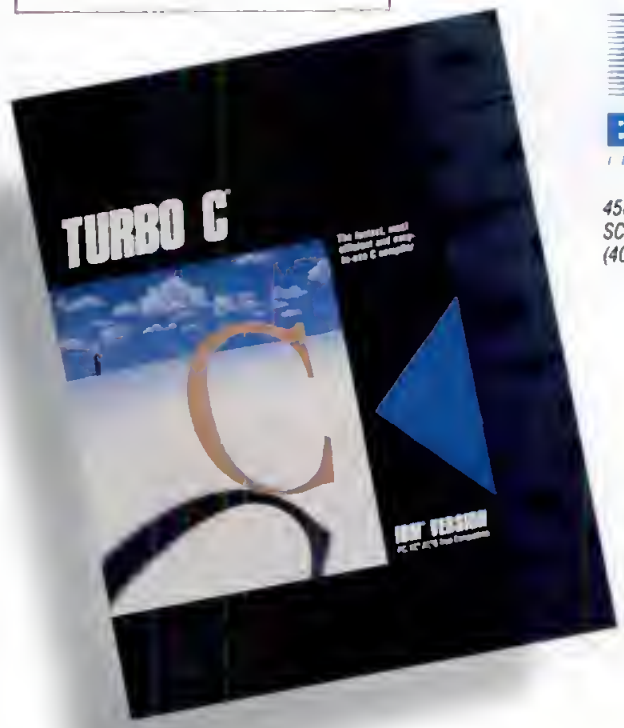

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Drafix Adds Spline Curves and Text Editing

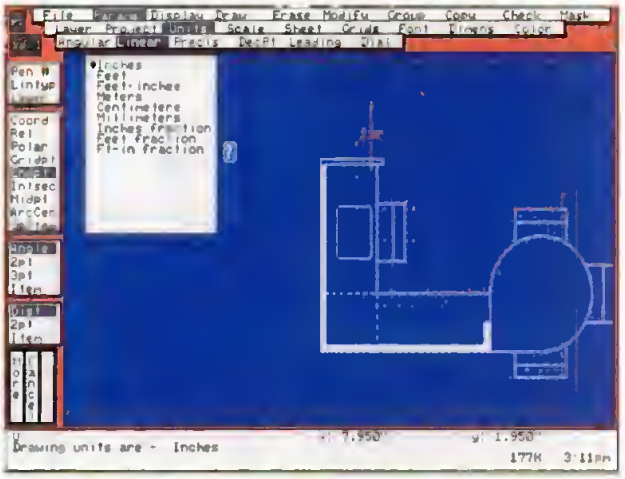
PC HANDS ON

BY DR. JOEL N. ORR

Drafix, from Foresight Resources Corp., became a hit when it was introduced last year because at $295, it gave you much of the power found in $1,000-plus systems, yet it used an interface that was easier than that of many of its competitors by several orders of magnitude.

Drafix 1 Plus is just as friendly. Experienced CAD users will find the menu layout unusual, but PC users will feel right at home: functions are listed from left to right at the top of the screen.

Drafix 1 Plus has a number of significant improvements over *Drafix 1* that turn the product into a functional production drafting system. In particular, the addition of splines, Bezier curves, and a freehand sketching capability expand the program's range to mechanical drafting and business charting. ASCII import and export allows power users to use *Drafix 1 Plus* in conjunction with other programs, such as bill-of-materials or material takeoff. And the pop-up text editor almost places *Drafix 1 Plus* in a league with Macintosh CADD programs, as far as text manipulation goes.



Drafix 1 Plus, by Foresight Resources Corp., features a pyramid menu structure that is a relief over AutoCAD's *disappearing layer approach.*

The program still lacks a user programming language. Nor does it have a command line interface, which advanced users will find disconcerting, but it is possible to assign functions to the PC's ten function keys.

Drafix 1 Plus has an extensive set of geometry construction commands and 255 layers. It supports grouping and masking, to make it easy to manipulate just those portions of the drawing that are of interest. It has a powerful symbol creation and management facility; Foresight offers libraries of symbols for sale.

I like *Drafix 1 Plus* for its polished presentation, its geometric adequacy, and its Macintosh-like knack of giving me a sense of mastery and privilege. By throwing in the formerly optional DotPlotter and General Symbols modules, Foresight has made *Drafix 1 Plus* one of the best buys in its price range.

I wish it had programmable menus, macros, and more keyboard command equivalents, but I readily forgive it these lapses for its sunny disposition. PC

PC MAGAZINE FACT FILE

Drafix 1 Plus
Foresight Resources Corp.
932 Massachusetts Ave.
Lawrence, KS 66044
List Price: $295 (includes General Symbols and DotPlotter); upgrade, $45.
Requires: 512K RAM, hard disk drive; Hercules, CGA, or EGA; DOS 2.0 or later.
In Short: Good combination of power and ease of use; addition of drawing symbols and text editing makes it an even better buy. Not copy protected.

CIRCLE 427 ON READER SERVICE CARD

Baker's Dozen Has a Spreadsheet, Byte Editor and Calendar but No Kitchen Sink

PC HANDS ON

BY EDWARD MENDELSON

If you can't find a use for the utilities in ButtonWare's *Baker's Dozen*, you probably don't own a computer.

You won't find a kitchen sink in this set of 14 miscellaneous programs, but you'll find almost everything else—from a calculator and a calendar to a FAT modifier and a file locator. Most of these programs are packed with options unavailable in more-expensive packages. The calculator is really a miniature spreadsheet with business, trigonometric, date/time, and other functions; it also supports range names and moves, sorts, and copies blocks, rows, and columns.

An all-purpose disk utility and byte editor lets you locate or modify anything on disk. The FAT editor is even more powerful and informative than the one included in *The Norton Utilities Advanced Edition*—and therefore more dangerous. Another part of the program lets you remove whole directories with a keystroke or recover deleted files. More than any comparable program, this utility gives you a sense of working in the nuts and bolts of the directory itself, rather than insulating you with elegant menus and pretty diagrams.

Less-dangerous programs include a file comparer that gives useful and customizable output, unlike DOS's COMP. Programmers will appreciate the thorough information on keyboard scan codes they can get from another program. Spreadsheet users will find a program that prints their work sideways on Epson printers, while still other programs set screen colors, switch serial or printer ports, sort files quickly, redirect printer output to a file, or capture screens for later review. All the programs can be run separately or from a master menu and include plain but adequate help screens.

You can buy *Baker's Dozen* with a printed manual or download it as shareware from any good BBS. Like many shareware programs, it doesn't look pretty, but it gets the job done. In fact, it gets 14 jobs done. PC

PC MAGAZINE FACT FILE

Baker's Dozen, Version 1.0
ButtonWare Inc.
P.O. Box 5786
Bellevue, WA 98006
(206) 454-0479
List Price: $59.95
Requires: 256K RAM, two disk drives, DOS 2.1 or later.
In Short: A varied set of plain-looking but powerful utilities. Not copy protected.

CIRCLE 426 ON READER SERVICE CARD

Turbocharge Your Programming With Turbo Basic!

> "Borland International's Turbo Basic is unquestionably an outstanding software product. It provides an efficient and comprehensive BASIC programming environment at a very affordable price.
>
> An excellent BASIC development system with enhancements that allow more effective programming."
>
> *Giovanni Perrone, PC Week*

Turbo Basic sets a standard for programming languages on PCs that is the equivalent of the first running of the four-minute mile.

Corporate users of BASIC will find Turbo Basic a tool worth many times its cost and a quantum improvement over anything they have ever used.

William Zachmann, Computerworld "

Turbo Basic® is the BASIC compiler you've been waiting for! It's a complete development environment with an amazingly fast compiler, a full-screen windowed editor, pull-down menus, and a trace debugging system. We've also added many innovative features including binary disk files, true recursion, and several new compiler directives to give you more control at compile time. And your program size isn't limited by 64K—you can use all available memory!

> "I'm extremely impressed with Turbo Basic. It's fast, it cooperates with resident keyboard handlers . . . it offers a wealth of important new features, and it costs only $99."
>
> *Ethan Winer, PC Magazine* "

A technical look at Turbo Basic

- Context-sensitive help
- Full recursion supported
- Customizability of user interface and editor
- Full 64K for strings
- Standard IEEE floating-point format
- Floating-point support, with full 8087 (math coprocessor) integration. Software emulation if no 8087 present
- Program size limited only by available memory (no 64K limitation)
- EGA and CGA support
- IBM Personal System/2 VGA and MCGA 2- and 16-color support in 640 x 480 resolution
- Full integration of the compiler, editor, runtime libraries, and executable program, with separate windows for editing, messages, tracing, linker libraries, user interface, and execution in one compiler file
- Compile, runtime, and I/O errors place you in source code where error occurred
- Access to local, static & global variables
- New long integer (32-bit) data type
- Full 80-bit precision
- Pull-down menus
- Full window management

BASIC Benchmarks

		Turbo Basic 1.0	QuickBasic 3/87
Compile & Link to Stand alone .Exe		*3*	17
Size of .Exe		*32753*	41162
Execution Time	w/80287	*18 secs*	25 secs
	w/o 80287	*109 secs*	114 secs

Benchmark by Jerry Pournelle run on IBM PC/AT with 80287 at 8 MHz with IEEE floating point. Benchmark fills two floating-point matrices with 50 elements, multiplies the two matrices and sums the results Sum = 23345440.1355113

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CIRCLE 179 ON READER SERVICE CARD

COMMUNIQUÉS

edited by Bill Howard

Desperately Seeking Pete Peterson

Is Microsoft jealous of WordPerfect's success? Did Microsoft programmers have *WordPerfect* on the brain when they designed *Word* 4.0? Consider pages 222–223 of the *Using Microsoft Word* reference manual:

"For example, if you type *Pete* in the "author" field, Word finds Pete, Peter, Peterson, etc. You can use the logical operator, NOT, to rule out forms of a word you don't want to search for . . . Example: *Pete~Peterson* tells Word to search for Pete only, not Peterson."

Just coincidence that Pete Peterson is executive vice-president of WordPerfect Corp.?

Archie Bunker Is Alive and Well . . .

"Direct Access . . . presents the users with simple menus in plain English, laminating the need to memorize DOS commands."

—J.B. Marketing (Cornwell, Ont.) dealer price guide

Breakthrough

["The Amstrad PC1512's] unique graphics card displays color graphics on a monochrome monitor, or shows up to 16 shades on a color monitor in the 80-column mode."

—CitiShopper *magozine, July/August 1987*

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["Master Control] is a complete control environment that gives you lightning fast, error free operation for your IBM PC/XT/AT or compatible with 256K. Master Control virtually eliminates any understanding of DOS commands or their syntax."

—Moster Control Systems (Chesapeake, Va.) brochure

New Math

Under the headline "Accounting at its Best," a Cougar Mountain Software (Boise, Idaho) ad offers the *ACT1* accounting program for "$99.50 plus $11.50 S&H. Total $11.00."

You'll Be Shocked By Our Prices

Beltron 286, $2,395. Add $150 for 0 Volt States.

—United Computer Resources ad, Philadelphia Inquirer, *August 24, 1987*

CAD:AVER.

(Computer Aided Design: A Video Evaluative Report)

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CIM Solutions ad,
Computer Graphics Today, *July 1987*

—Colorado Springs Gazette Telegraph, *July 15, 1987*

Man whose chips were down cleared in computer axings

Associated Press

FALMOUTH, Ky — The acquittal of a man charged with attacking three bank computer terminals with an ax in frustration over his debts has bank officials worried.

"He admitted he did it, and the facts were his bills weren't [illegible]. I certainly don't [illegible] the verdict. No one [illegible]t," said Wanda [illegible]

of first-degree mischief. He had been charged with destroying three computer keyboards with a double-edged ax.

Warren Shonert, the jury foreman, said jurors felt there were mitigating circumstances, "including the fact that Costigan testified that the bank would not allow him to close his accou[illegible] because he was filing fo[illegible] bankruptcy."

[illegible]honert said the ju[illegible]

"Because we're switching to another type of piracy."

Heard or seen anything offbeat, unusual, or just plain dumb about the computer industry? Send your offerings to Communiqués, PC Magazine, *One Park Avenue, New York, NY 10016, or MCI Mail 157-9301. Please print your name legibly and include your T-shirt size. Contributors receive $50 and a* PC Magazine *T-shirt. In case of duplicate entries, the earliest postmark prevails. Sorry, but entries can't be acknowledged. And please, don't send ads for sloppy drives or leather quality printers.*

Winners this issue: Dave Kumpf (chips were down), Richard Rickard (laminating DOS commands), Jock Devlin (eliminates understanding), Dan Griffith (monochrome color), Stephen Manes (Datavue Snap), Ed Mendelson (Word 4.0), Bert Tyler (0 volt states), Floyd Petersen (ACT1), Jim Garber (CAD:AVER).

Illustration: H. L. Schwadron

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MOST FREQUENT UAGE WAS !%?$#&*!"

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* Using the suite of 48 comprehensive benchmarks published in Data Based Advisor, March 1987.

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CIRCLE 114 ON READER SERVICE CARD

■ FROM THE EDITOR'S SCREEN ■ BILL MACHRONE

COMING TO TERMS WITH OS/2

Fear, anger, doubt, distrust. To hear some folks tell it, OS/2 is the worst thing to happen in the history of personal computing. What's the real story?

When's the last time you heard anyone say anything nice about OS/2? Face it, Attila the Hun had better press. I've come to lump OS/2's detractors into three categories: the disenfranchised, the disgruntled, and the disinformed.

The disenfranchised were the first, and most voluble, group. To a large measure, they are responsible for the creation of the other two groups. The more you know about DOS, the more likely you are to be one of the disenfranchised. I know programmers and consultants who can list the DOS interrupts and functions the way I could list the Yankees' batting order when I was 9 or Chevrolet's option list when I was 17. They've disassembled IBMBIO .COM, and they know more about the environment space than your tongue does about your teeth.

Suddenly, Microsoft comes along and pulls the rug out from under them. Forget interrupts. Forget TSRs. It's a whole new ball game and it's tantamount to having your livelihood taken from you. Small wonder, then, that these people knock OS/2. Whatever it is, it's got to be terrible.

The disenfranchised must have had distant early-warning radar. They were out there early, when the few alpha copies of OS/2 that were around were still called 286DOS (at least they found a better name). The military would love to have had that radar, too, because it was also a crystal ball. How else could they have known so much about code that was more a feasibility study than a finished product? But the disenfranchised determined that it was huge (correct on that count), slow, incompatible, and unwieldy.

HAVE A ROTTEN DAY The disgruntled are the professional naysayers. They hate change, but not because they're disenfranchised. They just hate it. They aren't even as intellectually respectable as the Luddites. The disgruntled also seize any opportunity to knock the big guys. They don't need a reason beyond bigness. If IBM or Microsoft is behind it, it can't possibly be good, right?

The disgruntled in this case have been fueled by the disenfranchised. If they needed any justification for their sour outlook, it's there in apparent plenty. They didn't like any new version of DOS, *1-2-3*, or *WordStar*, so there's no way that they're going to like a whole new operating system. Next time you hear one of these characters spouting off about OS/2, pretend he's in a Mel Brooks movie: in your mind's eye, paint on five days' beard growth and a mad-dog expression, and translate his words to, "Multitasking? We don' need no steenking multitasking!"

Illustration: Warren Gebert

DANGER IN DISINFORMATION The disinformed are the most dangerous. They are generally good, honest people who have been sold a bill of goods. They don't have any particular ax to grind, but they believe the disenfranchised and the disgruntled. Then they piously repeat the unwarranted allegations. Worse, they may be takers-up of causes. Thus, brandishing half-truths and misunderstandings, they sally forth into battle.

Sometimes you just get tired of it all. That's what happened to contributing editor Charles Petzold, one of the enfranchised. Knowing the technical innards of DOS and PCs and writing intelligently about them has been Charles's livelihood for 3 years. But he's not resting on his laurels. Charles began Environments, our OS/2 column, in Issue 16.

Yesterday, he sent me a brief note via MCI Mail, calling the disinformed onto the carpet:

"I was thinking about doing a 'myths and facts' piece about OS/2, partially in reaction to the garbage I'm still seeing in the press and hearing from people who should know better. It's amazing (well, maybe not) to read, 'Is it true, as speculation has it, that OS/2 is slow and eats up a great deal of memory?' Why don't these people boot it up and find out?

"This comparison took about 10 minutes (all times in seconds):

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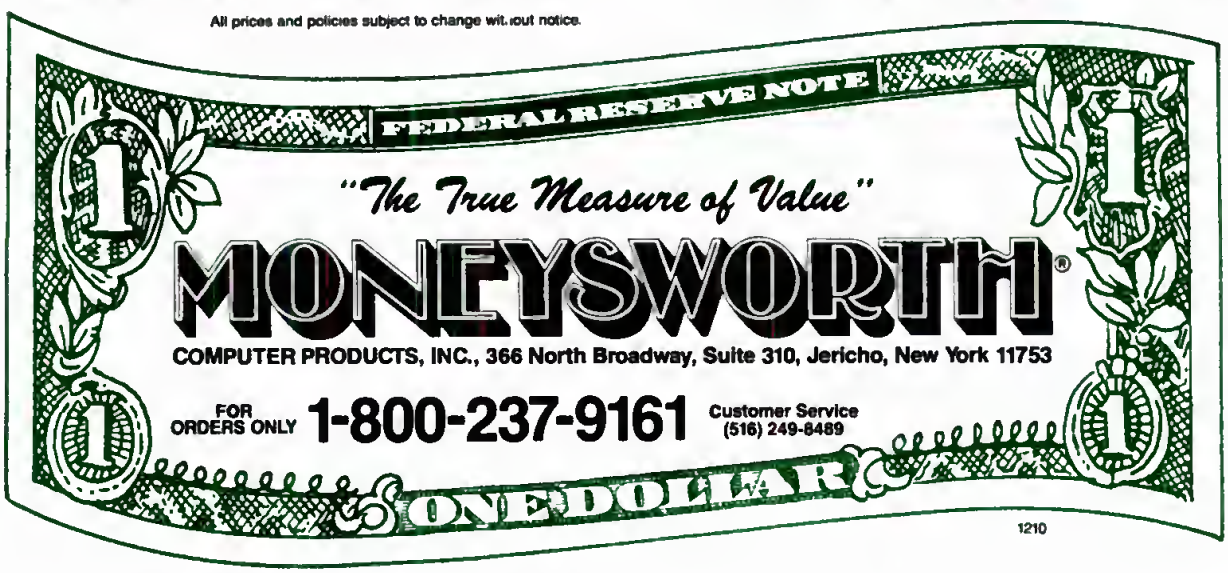

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■ EDITOR'S SCREEN

Coming to Terms with OS/2

Operation	Timing (seconds) DOS 3.2	OS/2 (alpha version)
DIR (191 files)	10.2	8.3
TYPE (64K file)	69.0	24.9
CHKDSK (3,771 files, 286 directories)	39.2	34.9

"You would think performance improvements like this would be big news, wouldn't you?"

Correct, Charles. I'm baffled as to why everyone is still speculating about OS/2 when beta copies are everywhere. They come with the Software Development Kit. In fact, OS/2 will likely be faster than the current version by the time it reaches production. Beta software is usually chockablock with debugging code and programmers' hooks, which tend to slow it considerably.

Oh, OS/2 is far from perfect. Right now it can't run asynchronous communications any faster than 1,200 bits per second, although the performance target is 56,000 bps. There are some unresolved issues in access to the video display. It demolishes the 640K-byte barrier, but leaves the 32-megabyte file limit intact. Without Presentation Manager, it's still pretty dumb about handling the screen.

But software developers are salivating. They're thinking of things they can do with virtual memory, task swapping, sophisticated device drivers, and more.

There's still so much we don't know about OS/2. Will multitasking raise or lower the overall performance of big applications? Will it ever be able to do communications in the background? Is it efficient enough to be a file server operating system and a user's operating system? Will it confirm the 80286 as a valid microprocessor, or will it send us screaming into the arms of the 80386?

It's fun to guess. It's smart to plan. But it's pointless to be judge, jury, and executioner for a piece of software months away from release. And it's just plain irresponsible to add to the already considerable pile of disinformation.

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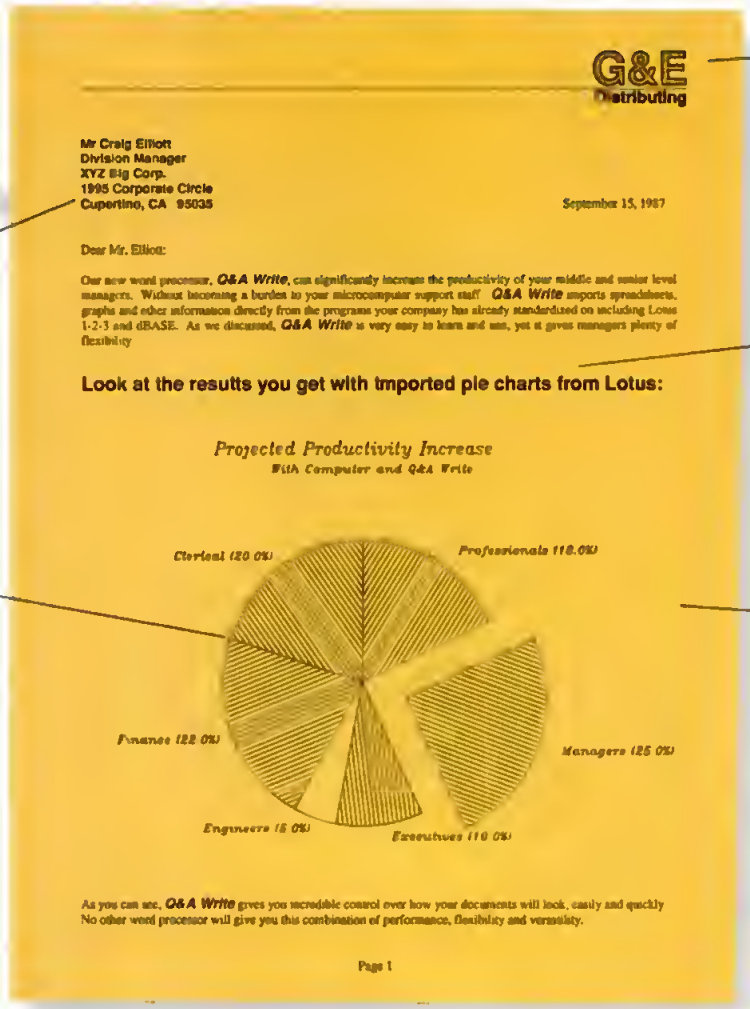

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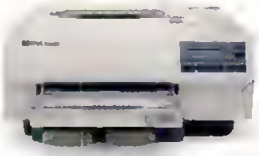

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CIRCLE 110 ON READER SERVICE CARD

■ JOHN C. DVORAK

THE REVOLUTION IS IN THE FRONT

PC users are lazy, unimaginative, and short-sighted. If you don't think so, take a look at what Macintosh users are up to—they're pushing their machines to the limit.

It's getting worse. That's the impression I got when I exited, once and for all, the latest Macintosh exposition and extravaganza in Boston a couple of months ago. What I'm talking about is that the Mac community is more alive than the PC crowd. While one observer claims it's because we're "more mature" than the Mac world, I don't think so. I think we're too lazy to get off our duffs and see what's going on out there and then demand it for ourselves.

At the Mac show, for example, *everybody* was excited about *every* new product that paved the way toward the future.

There were Macintoshes running with transputers and gate arrays and out-mipping minicomputers. People were excited. The large-screen Supermac 1100 dot color monitors were everywhere. It's not that everybody could afford the bugger at $3,500 or so. It's that everyone wanted one and a lot of people who couldn't afford one would make the sacrifice.

Contrast that with an IBM PC show, where all you see are EGA cards and XT clones and aisles populated by penny-pinching PC users.

I can't tell you how many times some guy has said to me, "I think an XT is all I'll really need. I just hope it holds up for 5 or 6 years." Buying an XT today to use for the next 5 or 6 years is like buying a piece of steak to eat for the next 5 or 6 years.

At first, when I saw the Mac stuff, such as the 24-bit compatible display that allowed the full use of 16.7 million colors at once, I said, "There's stuff like this available for the PC. What's the big deal?" It took me a minute to figure out what was wrong with this picture. For example, at the last Comdex, Number Nine Corp. was there with its fantastic display cards. Nobody paid much attention to them or anything else interesting.

Anything, that is, except Lotus utilities or other low-tech, low-price miracles. Take *Note-It* (please!). Here's a fine little product that allows you to add notes to cells within a Lotus spreadsheet. Yawn. While *Note-It* is a fine product for the Lotus addicts who can't imagine anything in the world a computer might be useful for except spreadsheets, there is more to life than this. Let's face it, *Note-It*, *1-2-3*, *Macro Magic*, the *Hubba Hubba Spreadsheet Accelerator*, *All You Ever Wanted to Know About Lotus and Were Afraid to Ask*, and every other spreadsheet add-in, add-on, utility, or whatchamajigger is a big bore. I'm a little sickened by it all.

Meanwhile, the Macintosh users have

computers that talk! And if you really want to see fancy spreadsheets, then look no further than the original *Excel* from Microsoft (as opposed to the soon-to-be-released, warmed-over *Windows* version) or *Trapeze* from Data Tailor in Fort Worth. *Trapeze* is a free-form spreadsheet that has virtual cells to be placed anywhere within a graphical environment. It's impressive.

ECCENTRICS In the early days of the microcomputer revolution there were mostly CP/M system users and Apple II users, with a few offbeat Northstar users who went to CP/M when they had to. The best people were in the CP/M camp and went on to the PC camp. The creative oddball always seemed to reside in the Apple II camp. Now it's the Mac camp.

The Apple II had color, graphics, and great games. The CP/M world thought that using real terminals hooked to the computer via an RS-232 port was a good idea. It proved to the skeptical mainframers that the machines were serious. It was a bad sign. The Apple aficionados didn't care what the world thought about the machines. They found them useful. They concentrated on using creativity to make the machines do tricks never before seen. Why worry about what dopey mainframers thought? It was no coincidence that, in this environment, the spreadsheet program was invented on an Apple II. So the creative energy was on the other side of the fence then and it appears to remain there. Maybe a little enthusiasm will help us out. This is embarrassing. In fact, it's pathetic.

Illustration: Warren Gebert

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CIRCLE 245 ON READER SERVICE CARD

■ JOHN C. DVORAK

INSIDE TRACK

Where's the Model 25's Yamaha sound chip? What's the best desktop publishing book? How much does it weigh?

Anonymous Quote of the Month Dept.: "IBM is doing everything it can to keep the Apple IIgs alive." That was said when IBM released the Model 25 without a music chip and without a voice chip. "No sound chips for a machine that is supposed to be sold to the schools? It's ridiculous," one designer told me.

The **screwball aspect** to all this is that many development companies were told by IBM to concentrate on designing their products using a special add-in card containing the **Yamaha music chip.** The way it was presented to them, there was an implied wink-wink-nudge-nudge, as if to say, "Expect to see *this* jewel built in to our surprise machine." So when the Model 30 was announced the developers all looked at each other, winked, and said, "Boy, will everyone be surprised when the next machine comes out with that Yamaha chip set in it."

Guess which group was most surprised when the machine came out sans music chips? And now what do those developers think about the **disappointing** outcome? They're all big boosters of the **Tandy 1000 TX**—a $1,199, 80286 screamer. Combine its promises with the $699 Tandy 1000 HX and with a $399 monitor and you can see why Tandy is the **real threat to Apple in the school districts.** Both have decent sound chips, I might add. IBM's inability to properly address this marketplace should be discussed in Armonk, seems to me.

Just in Time for Christmas Dept.: Those crazy guys at Salinon Corp., makers of *Headliner* and *Namer*, programs that manipulate words to create new phrases or company names, have done it again. A cute package called ***Off-The-Wall*** takes phrase patterns and generates, from scratch, new sayings and buzz phrases. Most of them are silly. But for $29.95, it may make a great gift for that budding writer in the family. My first pass with the thing resulted in sayings such as "Deterioration is the best sobriety." I liked "**Go ahead! Sponge my rock!"** And, finally, "Please!! Knock some mismanagement into that goat." You get the idea. Salinon is in Dallas, Texas. Call them at (214) 692-9091.

The Greatest Book on Desktop Publishing Dept.: I've seen many books on desktop publishing. Most are decent introductions. Throw them all away! I've discovered the vaunted **definitive** book on the subject. This 770-page, 8½- by 11-inch tome is simply incredible. It's the ***Illustrated Handbook of Desktop Publishing and Typesetting,*** by Michael L. Kleper. There is nothing like it. Kleper is a full professor and teaches graphic arts at the Rochester Institute of Technology. The book covers the subject thoroughly and with the proper historical perspective. It's a must for anyone with a computer who wants to use anything other than a dot matrix printer. **Fabulous book.** It's $29.95 from Tab Professional and Reference books. If you can't find it, order a copy from Graphic Dimensions, 8 Frederick Rd., Pittsford, NY 14534 (add $4 for shipping and handling—it weighs a ton).

Genuinely Interesting Software Dept.: If you live in a coastal state and like to go to the beach, enjoy sailing, or love to fish, then you must have a copy of ***TideMaster.*** It will knock your socks off. Essentially it generates the true tide tables for the next year and a half. It will also graph the tides so you can visually spot those ultra-low tides and extra-big high tides. Note: by no means is this a piece of trivial software. In many ways this is what computers are all about. If I were a student of the user interface, I'd play with this program just to see the excellent screen handling. It's available on a state-by-state basis. You tell them the state for which you need the tide tables and they send you a disk. $39.95 for any coastal state.

You can also buy a full set of 22 disks for the 22 coastal states for $399.95. The software was developed by **Coastal Computer Corp.** and can be ordered from Zephyr Services, 1900 Murray Ave., Pittsburgh, PA 15217. Call them at (800) 533-6666.

Pet Peeve Dept.: Here's a tip for the editors of the hundreds of newsletters around the country. Get a copy of the August issue of ***Sacra Blue,*** the excellent Sacramento IBM PC User Group newsletter (SPCUG, Box 685, Citrus Heights, CA 95611; (916) 332-1944). In it the editor discusses the July meeting, which featured **AT&T National Accounts honcho** Marty Sayer. Far too many newsletters never report the speeches given at their meetings. Some writer says, "So and so spoke for about an hour about the future of the company," then goes on to talk about the ramblings of the Lotus SIG.

Not the case with *Sacra Blue*. The speeches are extensively reported. We discover here, for example, some inside dope about AT&T's plans.

AT&T is going to push a UNIX running multiple DOS tasks on its 386 machine. There will be no emphasis on OS/2. Furthermore, the 386 is guaranteed to outperform the Compaq and IBM offerings, according to Sayer. This is good stuff.

So all you newsletter editors out there take note. When you get some guy spilling his guts, tell your readers the details. Don't assume every soul went to the meeting. This is valuable stuff. **Kudos** to the boys in Sacramento.

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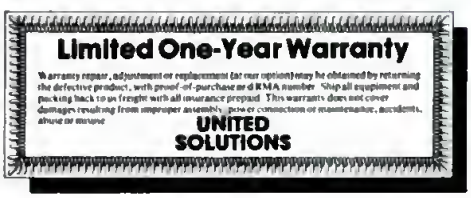

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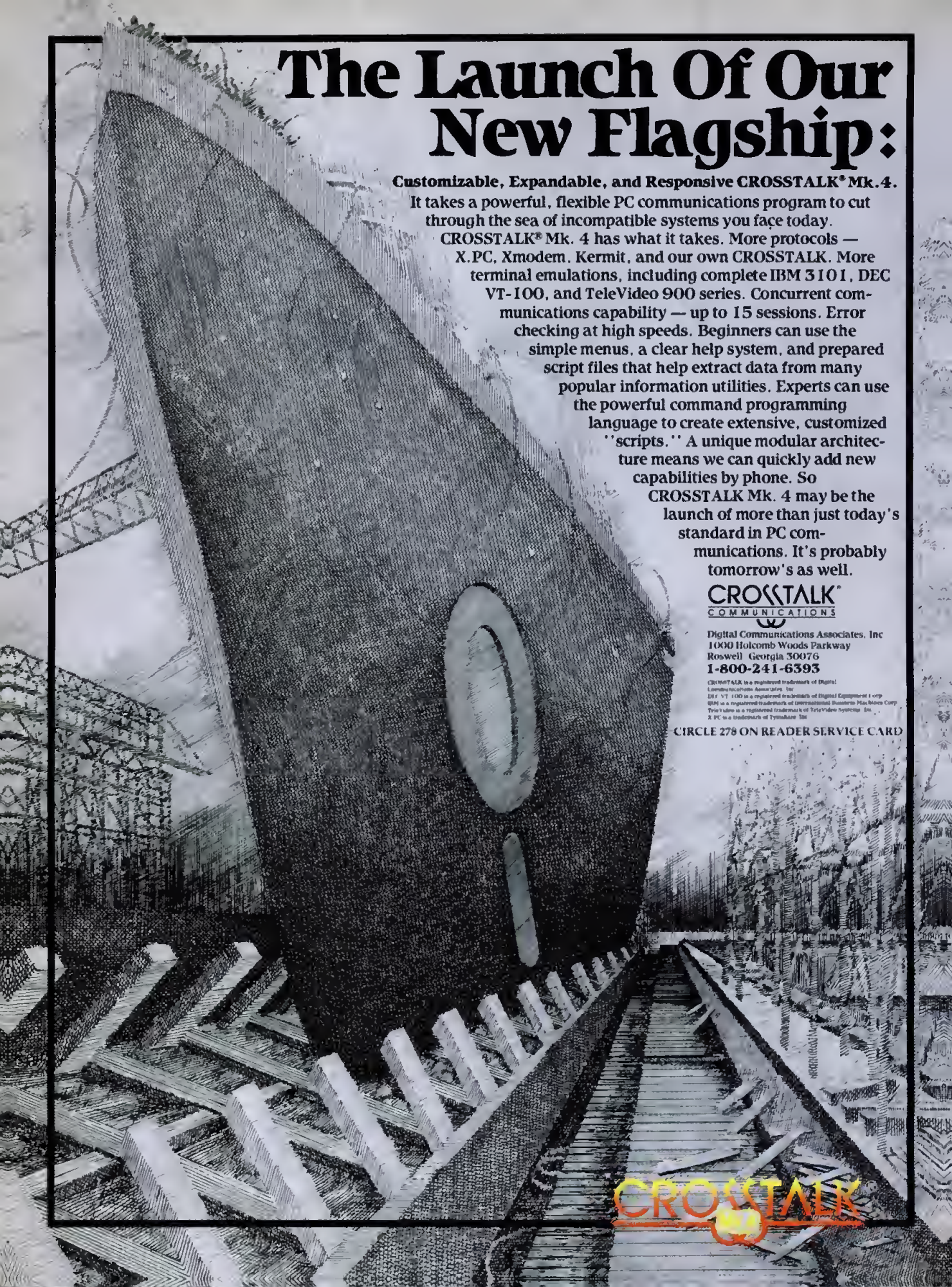
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■ JIM SEYMOUR

PROGRESS IN INTERFACE DESIGN

Major improvements in software interfaces are few and far between. Unfortunately, one of the best designs is buried in a long-overlooked program.

This year's litigation wars in the PC business—starring, of course, Lotus Development Corp. in "The Look and Feel Follies of 1987"—have, I suppose, had their positive sides. One of which has been to focus users' and software developers' attention on interfaces.

The *1-2-3*–style moving-bar menu is not at issue in Lotus's actions. The company's not claiming the moving bar is its innovation—it didn't, after all, invent it—but rather it's claiming specific keystroke sequences and other matters. But that moving-bar menu, which was certainly widely popularized by Lotus, remains a major step forward in interface design.

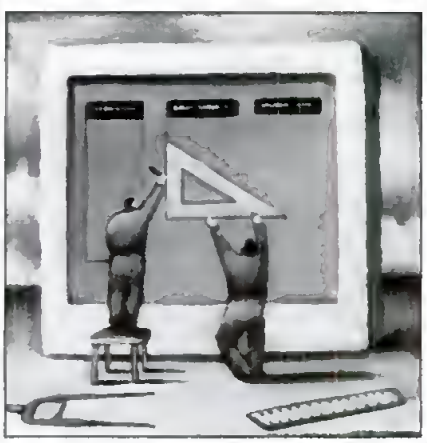
It's far better than full-screen pick-a-number menu interfaces (à la the original *PFS:* design from Software Publishing), because you can see the menu in the context of also seeing your work on-screen. And it's better, I'm convinced, than the pull-down menus so much in vogue today. It may be that the Macintosh imperative—now being advanced in the PC market by *GEM* and *Microsoft Windows* (and by *Ventura Publisher*, *Excel*, and other products running under them) and by the adoption of pull-downs by vendors from Borland to IBM to Autodesk—is unstoppable.

If so, perhaps sometime soon we'll be saying goodbye to the moving bar and other interface styles because pull-downs have become so ubiquitous.

BYE-BYE BAR If that does happen, it'll be our loss. Pick the right keywords for those menu items, so their initial letters aren't in conflict, and moving-bar menus offer the best of both worlds: fast, command-line-like execution for those who know the program well (as in a fast RFC0 <Enter> for Range, Format, Currency, 0 decimal places, to assign a dollar-sign format in *1-2-3*) and more leisurely, tentative, exploratory shopping along the menu line with cursor keys for those still unsure of what does what in the program.

But there's an exception to the glories of moving-bar menus: how easy it is for anyone short of expert status to get lost several levels down in the maze. True, you can always back out by repeatedly hitting the Esc key. But that's not much help if you're digging around trying to find a little-used command you know is buried in there *some*where.

Which has led us to what I think is the next logical extension of the moving-bar menu idea: the moving *and expanding* bars of *Lucid 3D*, a new memory-resident spreadsheet just now starting to ship from Dallas's Portable Computer Support Group.



Illustration, Warren Gebert

PCSG's in no danger from Lotus, I assume, because although it uses a moving-bar menu, it doesn't look like the Lotus menus, and it doesn't use the same keywords. Even better, *Lucid* itself isn't new but has been around for a long time in a far simpler version as plug-in ROMware on the Tandy Model 100. *Lucid 3D*, the PC version, is a brilliant program in many ways, but PCSG's enhancement of the moving-bar menus idea may be its best feature.

As you make menu picks from *Lucid*'s menu bar, the program drops down second, then third, then fourth (if necessary) horizontal moving-bar sub menus superimposed over the screen of the program over which *Lucid* popped-up. The entire path you've wound through sub menu levels remains visible on-screen, so you can see the whole menu tree you've pursued: where you've come from, how you got there, what else falls under this category on the main menu bar.

Though the PCSG people seem safe from Lotus's legal forays, I'm not sure how secure their approach to combining moving-bar menus with something like pull-downs is. Because if ever there was an interface idea so good it *ought* to be stolen and widely used, this is it.

I suspect that before long we'll see slight variations on the *Lucid 3D* menuing system, some of them improvements, appearing in other new programs. Which is as it should be.

■ JIM SEYMOUR

A GREAT LOST IDEA There haven't been many generational leaps in PC software interfaces, and some, sadly, have been lost by the wayside in the ebb and flow of a frenzied market.

Jim Edlin, the first editor of *PC Magazine*, left to develop *Wordvision*, an early low-cost PC word processing program with one of the most intelligent, intuitive user interfaces ever seen. Today, *Wordvision* has become a footnote to PC history, still available (but only by mail from Edlin), still cherished by thousands of users who knew a better idea when they saw it. *Wordvision* has been left behind in the WP derby by other, more widely distributed programs that have produced sufficient cash flow to sustain continuing R&D and improvements.

■ Today, *Wordvision* has become a footnote to PC history, still cherished by thousands who knew a better idea when they saw it.

But improvements in software interfaces don't have to be generational to be important. Use *Paradox* for a few minutes, and you'll see an important extension of the moving-bar menu approach. Use the newly revamped *Harvard Graphics* for a few minutes, and you'll get a lesson in how to handle complex menus and branching from the first screen without overwhelming the user. Use the installation program in *Microsoft Windows*, and you'll see a simple, intelligent approach to handling what is for many, even experienced PC users a daunting job.

Windows believers insist that it and its True Blue successor, OS/2's Presentation Manager, are the wave of the future, making all questions of other interfaces—whether graphic or character-based—irrelevant. Maybe.

But as much as I like graphic interfaces generally, and *Windows* particularly—and best of all, the Mac-like application-to-application consistency possible with a clutch of programs running under *Windows*—character-based interfaces are going to be with us for a long time to come.

We ought to spend more time making them better, as PCSG has done, and less time whining about the genealogy of those improvements. PC

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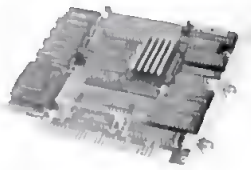

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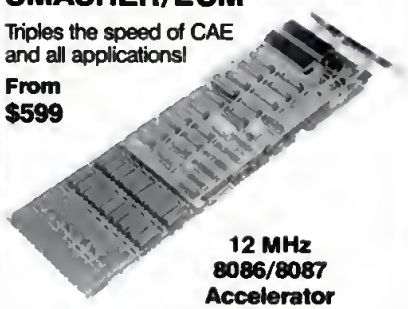

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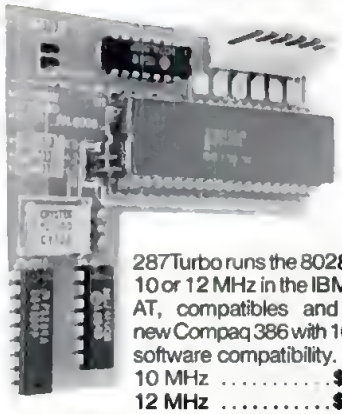

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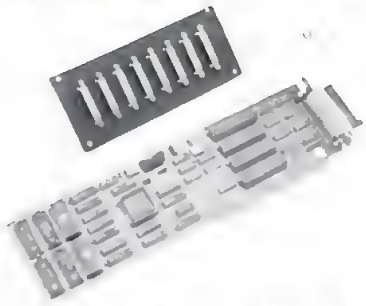

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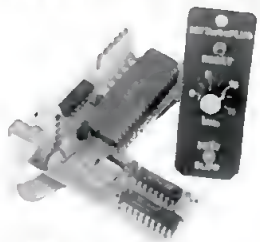

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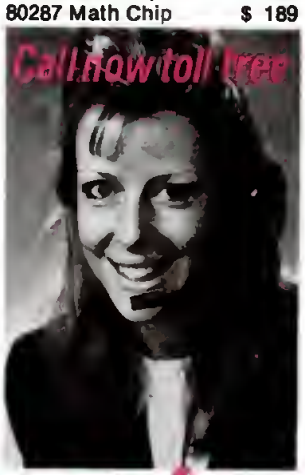

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OS/2 SOFTWARE: THE QUICK AND THE DIRTY

What hot new software might make you empty your bank account, reformat your hard disk, and switch to OS/2? The hot old software you're running now.

Both of my readers have written to inquire what I think of OS/2. A few weeks ago I would have snorted, guffawed, chortled profoundly, included the word "joke" in my reply, and noted that a real operating system for the 286 chip, when and if it ever arrives, will have taken longer to create than 365 Days, Nights, Heavens, Earths, and Seas. If Bill Gates is a god, he's the one who rides a snail.

But I now suspect many of us will be using OS/2 sooner than we guessed—assuming the initial release isn't significantly delayed, that it actually works, and that the barons of applications software don't screw up.

How come? Take TSR programs—please. They're oh-so-seductive, but just about every one demands "only 80K" you don't have to spare in this era of "512K required, 640K recommended." Then come the compatibility pains: figuring out loading sequences, picking "hot keys" that don't conflict with hotter keys, and hoping that everything coexists peacefully when you pop up a pop-up over a pop-up. In theory, OS/2 could put an end to much of this nonsense.

Most TSRs don't give you real multitasking, either. As soon as you pop something up, what's below screeches to a halt. Once you've dabbled with a print spooler or concurrent communications, you begin to lust after as much multitasking as you can get.

True, control programs like *Windows* 386 (unavailable at this writing) and *DESQview* (on the stands now) will take good old DOS applications and run them concurrently. But they generally must live with the limitations of DOS—including the 640K-per-application limit and the lack of protection for simultaneously running programs, which can invite truly horrific crashes. Because control programs offer developers nothing beyond DOS, they're mired in yesterday's—i.e., today's—applications.

ON THE GOOD SHIP OS/2 Just as programmers abandoned CP/M for DOS, they're likely to ditch the leaky DOS scow and set sail on the good ship OS/2. Granted, one good reason to be skeptical about OS/2 is the ominous fact that the only folks currently enthusiastic about it are programmers. But one thing they seem enthusiastic about is actually using it—for example, to continue programming while waiting for a long compile to finish in the background.

OS/2's real cost can be a real deterrent:

Illustration: Warren Gebert

$325 for the software is only the beginning. You'll also need a 286- or 386-based system, 500-odd K of memory just to run the system (assuming it doesn't get any bigger), plus gobs of memory for applications and a fast hard disk for virtual-memory swapping. Figuring $600 or so for the memory and assuming you've got the 286 and the disk, the ticket price for OS/2 is about $1,000. But hey, the future rarely comes cheap.

Most OS/2 publicity heralds the wonderful new software coming soon. In reality, "soon" may mean years. The first release of OS/2 will be quick and dirty—yet another iteration of the DOS character-and-command-based user interface. The Presentation Manager (*Microsoft Windows* OS/2) will not be seen until at least 6 months after the rollout, with few applications available even then. So where will actual OS/2 applications come from? Answer: developers following IBM and Microsoft on the quick-and-dirty low road.

THE PENALTY BOX Forget OS/2's DOS Compatibility Box, which is more like a Penalty Box: It will run DOS programs, but slowly, only in the foreground, and with the lose-big potential to bring down the entire system, including all the OS/2 programs in the background. The CB will eventually be regarded as a handy tool to let you demonstrate lame DOS relics without making you find your DOS boot disk in its moldering pile. If you want OS/2, you want OS/2 programs—and specifically optimized programs to, pun intended, boot.

■ STEPHEN MANES

But what you want and what you'll settle for at the outset are quite different. The best way for OS/2 to emulate the success of DOS is for developers to quickly release OS/2 versions of DOS programs. If the software industry doesn't have its head in granulated silicon, what should appear in a big hurry is a raft of OS/2 applications exactly like the ones you're using now—except that OS/2 will let them address scads of memory (even memory you don't have) and run concurrently.

What you want is a supersophisticated souped-up version of *1-2-3* that can recalculate in the background so there's never a wait. What you'll settle for is a *1-2-3* that can run with other programs (or itself) so that while you wait for your 15-megabyte spreadsheet to recalc you can work on another or run that neat text adventure.

Quick porting of proven programs was one big reason the IBM PC became so successful so fast. Virtually every early PC software hit was a little-changed version of 8-bit CP/M or Apple software. Programs like *VisiCalc*, *SuperCalc*, *WordStar*, and *dBASE II* made up the core of the PC software library for many moons while programmers explored the advantages of the new machine—advantages that led to the brilliance of the *SideKick*s, *1-2-3*s, and *Paradox*es. The availability of the clunky-but-classics set the stage for the new wave.

THE PRICE IS RIGHT? It can happen again—if the price is right for the OS/2 editions. Some slick marketing types will no doubt assume that users willing to shell out a grand just to get OS/2 running won't mind forking over more big bucks to get OS/2 versions of their favorite DOS programs. That policy is a brilliant way to help delay the broad acceptance of OS/2.

If the quick-and-dirty porting process is as easy as programmers claim (though programmers' claims are about as reliable as original AT hard disks), this kind of OS/2 product qualifies as an upgrade. Offering it cheap will create a body (not to mention mailing list) of grateful pioneers who'll be ready to shell out big for the full-featured all-singing, all-talking, all-dancing, all-graphics versions down the road. Premium prices may then be justified; for the same old stuff in a frilly multitasking frock, they're not.

If you do anything more sophisticated than just processing keystrokes, and if OS/2 turns out to be anywhere near as good as its backers claim (which, despite programmers' huzzahs, is by no means certain), it's probably a question of when, not if, you're going to use it. Cheap quick-and-dirty upgrades of your software favorites should make the answer "sooner" rather than "later." PC

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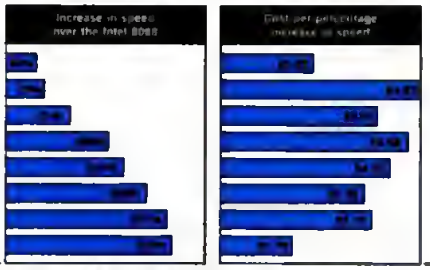

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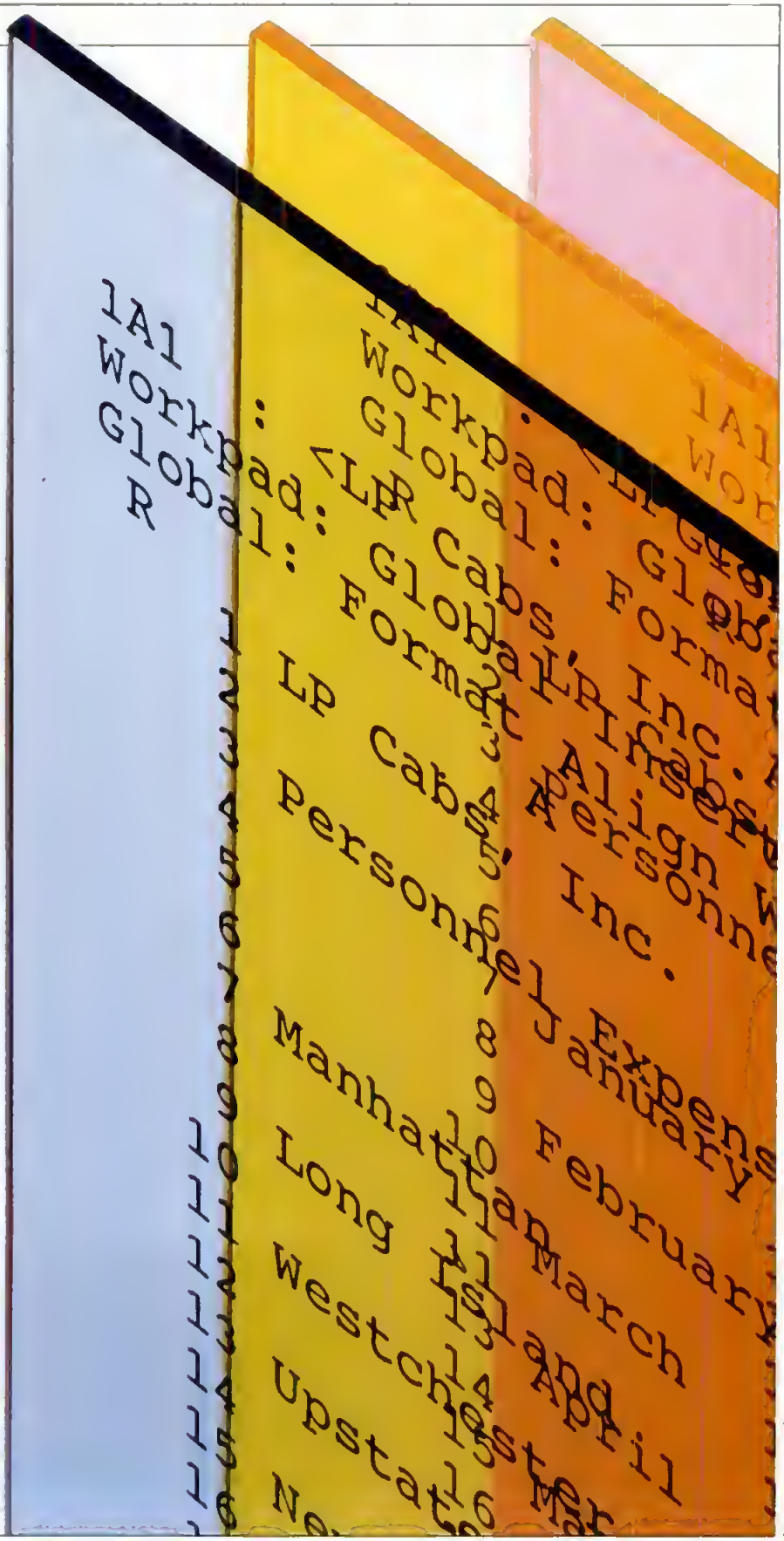
Spreadsheets, word processors, and databases have helped to transform the very texture of life in the office: business would lurch to a stop without them. And, of the three, spreadsheets take a certain historical pride of place. It is spreadsheets that have charted the early progress and power of the microcomputer industry. Their history is the history of the microcomputer.

What likewise sets spreadsheets apart from the others is the dominance of a single program. Lotus Development Corp.'s *1-2-3* has a tight grip on the market that isn't likely to be loosened by competitors from its own generation. Years ago, *1-2-3*'s market share reached critical mass, and conformity to the Lotus standard became more important than buying a better program.

OS/2, the new operating system that will address 16 megabytes of memory and support the 80286 chip's protected mode, could change everything. Three or 4 years from now, spreadsheets will be doing things we never thought possible or haven't even thought of at all. They won't be souped up versions of what we see today—they'll be brand new, uncompromising programs that make no concessions to the cramped past of MS-DOS. And *1-2-3* may be an also-ran.



Photograph: Roberto Braun

FROM VISICALC TO 1-2-3 When Apple first introduced microcomputers, it was *VisiCalc* that turned a toy into a tool. Visionaries and pioneers brought Apple IIs to work, ran *VisiCalc*, and were soon outproducing everyone else in the office. *SuperCalc* brought the same respectability to CP/M machines. Microcomputers would have conquered the office with spreadsheets or without them, but without them, it would have been a slower, bumpier march. Word processing programs worked well on CP/M machines, but the computational needs of spreadsheets required more power.

Not long after IBM introduced its PC in

1981, Apples began to look silly in offices. They didn't have the PC's crisp, monochrome resolution or its top-quality keyboard. And they didn't have *1-2-3*.

1-2-3 was not the first spreadsheet to run on the IBM PC, though. Both *VisiCalc* and *SuperCalc* were available for MS-DOS a few months before *1-2-3*'s release in January of 1982. Microsoft's *Multiplan* was already out, as were less-well-known spreadsheets like *Report Manager*, which is still with us as part of McDonnell Douglas's *microCUBE*.

However, these programs had two strikes against them. The first was their parentage. Most had been written for other operating systems and then ported to MS-DOS, whereas *1-2-3* was written, from the ground up, for the 8088 microprocessor. *1-2-3* took advantage of the 16-bit chip and of the PC's ten marvelous function keys. To the extent that they didn't, *1-2-3*'s competitors got off to an awkward start.

The other blow to the competition was *1-2-3*'s advertising war chest: the then unprecedented figure of $4 million. This may have been what pushed *1-2-3* over the top, but the program had everything else going for it, too. It was serious, well-designed business software of the kind that had already turned other microcomputers into business machines. Even more important, it was for the right computer—the one that said IBM on it. Finally, it was released at the right moment, when IBM was pushing its machines in earnest and business had begun to buy them. *1-2-3* and the PC took off together.

In retrospect, *1-2-3*, or something like it, seems like an obvious product. And yet, it had more than a touch of good luck. When IBM first announced PCs, it didn't know if they were going to end up in the hands of hackers or on the desks of executives. The first 64K PCs came with a cassette port, remember? *1-2-3* put the PC in pinstripes, and businessmen decided that they liked it.

THE STANDARD Before long, *1-2-3* was the best-selling applications program in the world and was on its way to becoming the spreadsheet standard. But how did *1-2-3* take such a large piece of such an important market? Good quality and savvy promotion were part of it. But just as important was a feature that went into the program almost as an afterthought: macros. Lotus called them "The Typing Alternative" and didn't expect people to use them for much more than speeding up keystrokes. There were only 14 pages on macros in the manual.

But macros were a simple programming language, with gotos, subroutines, and true/false tests. This was enough to turn *1-2-3* into a development environment for commercial and shareware templates that did everything from mortgage calculations to hog feed analysis. These homegrown and store-bought macro routines clinched the market for *1-2-3*. You might

SPREADSHEET CONTENDERS PUT PRESSURE ON LOTUS

As new and better spreadsheets heat up the market, the big guns of the industry are putting the final touches on a new generation of contenders. Lotus Development Corp. has promised to deliver *1-2-3*, Release 3.0, by early next year, but it will launch the new version of the spreadsheet standard into the choppy wake of two major competitors. Coming to the market this fall are Microsoft's *Excel* for the PC and Borland International's first-ever spreadsheet. And, although these two products take very different approaches, both could put serious pressure on *1-2-3*.

LOTUS PLAYS COY Lotus has been coy about the details of Release 3.0 but will admit this much: the new version will add a new dimension to columns and rows by letting you stack spreadsheets on top of each other like pages. Live formula references from page to page will allow effortless consolidation. Lotus has also heard the plea of many a frustrated user and will give us better graphics and an "undo" feature. Besides this, we are promised better ergonomics, higher performance, and improved mouse support.

Release 3.0 will also incorporate the Lotus Extended Applications Facility, or LEAF. This is described as a step beyond macros, something that will allow sophisticated users to build even more complex applications. It will allow seamless communications within the Lotus "family" of spreadsheets: Release 3.0 and the forthcoming mainframe and graphics-interface versions. *Symphony* 2.0, which is expected this fall, will also talk LEAF. Finally, Lotus promises full compatibility with the current release of *1-2-3* to protect your investment in training and templates.

BORLAND COMPATIBILITY Borland's spreadsheet, *Quattro*, will take deliberate aim at *1-2-3*'s massive following. Like Daybreak Technologies' *Silk*, it improves boldly on Lotus standards but will stick to them where necessary.

There is nothing to install, except for printers. The program figures out what hardware you have, and you can configure your printer from within the program. You'll be able to control the colors on every part of the screen and use color intelligently to indicate numbers above or below a limit. Minimal recalc will improve calc speed: when you make a change, the program refigures only the numbers that are affected—not the whole spreadsheet. A search-and-replace function will find any string in your worksheet and let you replace it. You'll get all of *1-2-3*'s at-sign (@) functions, as well as several more, such as @dayofweek and @degrees. And like all good *1-2-3* challengers, the program will draw much better graphs.

The most dramatic improvements, though, are in the user interface and the macro language. The Borland spreadsheet will have a soft interface that lets you build any command tree you want. If you like the feel of *1-2-3*, you can set up menus to mimic it. If you have your own ideas about the commands, you can rewrite the whole interface.

The macro language will have ten more commands and a Learn mode, and

it will let you write an unlimited number of macros instead of *1-2-3*'s 27. It will also have an excellent debugger that lets you put absolute and conditional breakpoints in routines and trace the effects of macro execution on specific cells. Even *1-2-3* macros will work, no matter how you reconfigure the spreadsheet commands.

Finally, Borland will make a strong appeal to the pocketbook. *Quattro*, which will list for $195, will give you a lot more spreadsheet than *1-2-3* at a fraction of *1-2-3*'s $495 cost.

BOLD NEW MS TRAIL Microsoft is making a few concessions to the *1-2-3* standard but is carving out its own, distinctive look and feel in *Excel* for the PC. This is a beefed-up version of Microsoft's successful Macintosh program. It will come with a run-time version of *Windows*, so its scroll bars, dialog boxes, and icons will have a Mac-like personality that PC users won't find familiar. It will have a rich keyboard interface, but most users will want to run *Excel* with a mouse.

Excel will have minimal recalc and background recalc. It will recalculate the whole spreadsheet only if it needs to, and if you don't want to wait while it does arithmetic, it will politely suspend calculation while you work.

Excel will let you put multiple spreadsheets in memory and link them with formulas. Different spreadsheets can be active in different windows, and you can size, move, and hide windows to your heart's content. You'll be able to vary row heights, as well as column widths, to get fonts of any size. With a laser printer, you'll be able to print documents that no one will guess came from a spreadsheet. *Excel* will use color for certain kinds of values and will let you highlight your spreadsheet with boldface, italics, and shading. Its graphics will be presentation quality.

Excel will also have good auditing features that let you trace spreadsheet logic by listing dependent and antecedent cell references. You can document your work with notes on individual cells. There will be seven different kinds of formula error displays, so you can fix things quickly.

Excel's macro language will have a Learn mode and will let you call subroutines in C that you write yourself. You'll be able to write custom spreadsheet functions and design applications with menus, windows, and dialog boxes. Macros will also activate dynamic data exchange (DDE), which will let *Excel* pass data to and from other *Windows* applications and actually execute commands in other programs with simultaneous grace.

As an important concession to *1-2-3*, *Excel* has a built-in macro translator that should let most *1-2-3* macros run in *Excel*. It even has a *1-2-3* Help mode, which will tell you how to do something in *Excel* if you know the equivalent command in *1-2-3*!

Unlike Borland, Microsoft is not going to fight a price war. *Excel*'s list price is $495, the same as *1-2-3*'s.

—Jared Taylor

be able to translate spreadsheets from one program to another, but you couldn't run *1-2-3* macros without *1-2-3*. Lotus was the language that colleagues, clients, and competitors all spoke. Before long it just didn't make sense to buck the trend.

Standards feed on themselves, and *1-2-3* kept on booming. It spawned a huge aftermarket of templates, utilities, and accessories.

RELEASE 2.0 Nevertheless, by 1985, the 4-year-old spreadsheet began to look threadbare. Lotus's competitors hadn't been sitting still, and new versions of *SuperCalc*, *Multiplan*, and a host of upstarts began to look very good. Lotus finally struck back in September 1985 with Release 2.0. Release 2.0 was a seriously beefed-up spreadsheet with four times the worksheet space, plus coprocessor and EMS support, string functions, and 40 new macro commands. Another plus: Release 1A was almost perfectly upward compatible with the new *1-2-3*. Since then, Release 2.0 and its debugged successor, Release 2.01, have kept Lotus at the top of the spreadsheet heap.

1-2-3 continues to get a lot of help from non-Lotus programmers. The best-known third-party accessory is *HAL*, which lets you give *1-2-3* commands in something resembling English. Lotus liked the product so much that it bought the program before it was released and now sells it. Add-ins have given Release 2.0 another important boost. These take advantage of built-in "hooks" in *1-2-3* that let third-party programmers embed new features directly into the spreadsheet. After a quick modification of the *1-2-3* driver set, the program will recognize add-ins on disk and let you run them directly from within *1-2-3*. You can then do word processing, linear programming, or goal seeking, say, with the data that's *already in your spreadsheet*. As the number of add-ins grows, you'll be able to build your own integrated software program containing the features that suit you best.

NEW CHALLENGERS Release 2.0 is now 2 years old, and the spreadsheet market has hardly been sitting still. Some of the biggest news was the introduction, last year, of unabashed *1-2-3* clones. These were programs that mimicked *1-2-3*, Release 1A, keystroke for keystroke. The most famous were *VP-Planner*, by Paperback Software, and *The Twin*, by Mosaic Software. Both added features to *1-2-3*, but their main draw was price: a list of under $100 rather than *1-2-3*'s $495.

Earlier this year, *1-2-3* got tough and sued Paperback and Mosaic for copyright infringement. The cases may not be resolved for years, but the very nature of the industry could change according to how courts rule on the central issue: Can programmers use each others' good ideas, or can a company lock up the "look and feel" of a product with no more than a

Spreadsheet Programs: Summary of Features

(Products listed in ascending price order)

	TRADITIONAL SPREADSHEETS						
	The Twin Classic Mosaic Software Inc.	Words & Figures Lifetree Software Inc.	VP-Planner Paperback Software	Multiplan Microsoft Corp.	Planning Assistant IBM Corp.	PFS:Professional Plan Software Publishing Corp.	PC Silk Daybreak Technologies Inc.
List price	$99.00	$99.00	$99.95	$195.00	$195.00	$249.00	$298.00
SIZE AND SPEED							
Max. no. of columns and rows in work area	256×8,192	256×9,999	256×9,999	255×4,095	70×255	32,766×32,766	256×2,048
Max. no. of characters in cell/range name	239/15	238/15	255/14	255/31	25/25	250/100	4,000/15
Range of column widths	1–72	1–127.	1–72	1–64	3–25	3–100	1–240
Has sparse memory matrix to conserve RAM	●	●	●	●	○	○	●
Database can be larger than spreadsheet	○	○	●	○	N/A	N/A	N/A
Uses expanded memory	○	●	○	○	○	○	●
Uses math coprocessor	●	●	○	●	○	●	●
FUNCTIONS AND FORMULAS							
No. of math/logic/financial functions	18/8/8	17/5/5	19/5/5	11/12/8	7/1/3	21/7/13	17/7/11
No. of date and time functions	5†	5†	7†	12	8	12†	7
No. of statistical/string functions	7/0	7/0	18/0	6/15	3/0	9/0	9/18
No. of logical and arithmetic operators	14	16	15	17	13	17	15
MACRO CAPABILITIES							
Has learn mode for macros	○	○	●	●	○	●	○
Can run 1-2-3 macros	●	●	●	○	○	○	●
Macros reside in worksheet/library	●/○	●/○	●/○	●/○	○/○‡	○/●	●/○
MISCELLANEOUS							
No. of split screens	2	2	6	8	4§	24§	None
Split screens scroll/format independently	●/○	●/○	●/○	●/●	●/●	●/●	○/○
Cursor keys enter cell data	●	●	●	●	●	●§	●
Can back-step through previous commands	●	●	●	○	●	●	●
Hides columns/rows	○/○	●/○	●/○	●/○	○/○	○/○	○/○
Hides individual cell contents	○	○	○	○	○	○	●
Has cell protection	●	●	●	●	○	●	●
Formats cells to display numbers as words	○	○	○	○	○	○	●
Can merge contents of spreadsheets	●	●	●	●	●	●	●
Can import/export 1-2-3 files	●/●	●/●	●/●	●/●	○/○	●/●	●/●
Warns against file overwrite	●	●	●	●	●	○	●
No. of graph types	8	5	5	None*	None*	13	7
Has context-sensitive help	●	●	●	○	●	●	●
Does recalc in logical order	●	●	●	○	●	●	●

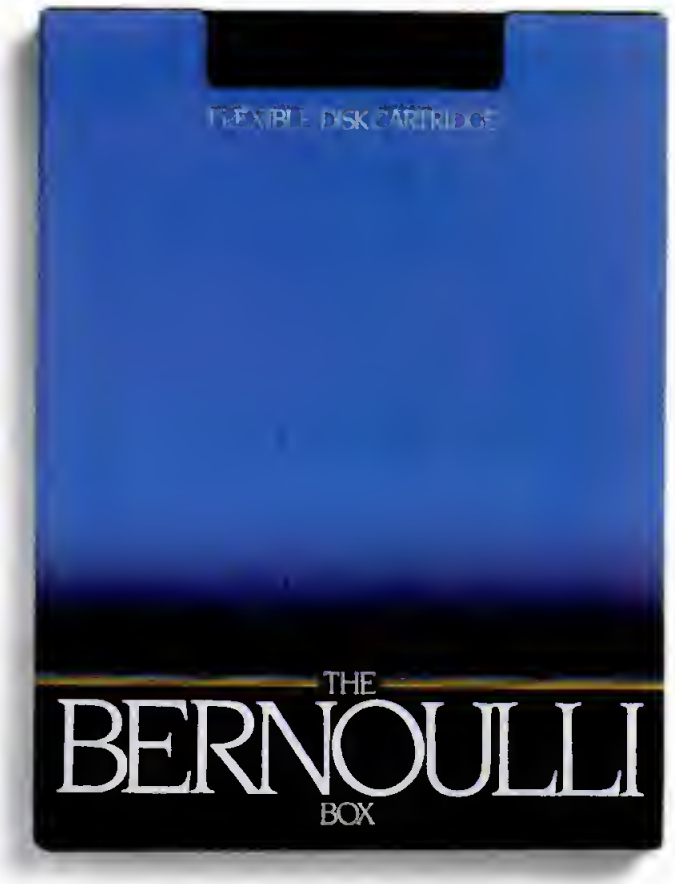
PC—Indicates Editor's Choice. ●—Yes ○—No. N/A—Not applicable; has no database function. *Program does not use ranges. †Date only. ‡Program does not use macros. §Has view capability.

3-D SPREADSHEETS

	PlanPerfect WordPerfect Corp.	1-2-3, Release 2.01 Lotus Development Corp.	PC/Focalc Information Builders Inc.	SuperCalc4 Computer Asseociates International Inc.	Javelin Plus Javelin Software Corp.	Boeing Calc Boeing Computer Services	microCUBE McDonnell Douglas Communi-cations	TM/1 Sinper Corp.
List price	$395.00	$495.00	$495.00	$495.00	$249.95	$399.00	$600.00	$795.00
SIZE AND SPEED								
Max. no of columns and rows in work area	256 × 8,192	256 × 8,192	1,000 × 1,000	255 × 9,999	Unlimited	16,000 × 16,000	255 × 255	9,999 × 9,999
Max. no. of characters in cell/ range name	255/20	240/15	235/0*	240/32	255/0	250/0*	256/30	72/0*
Range of column widths	1–255	1–240	1–235	1–127	1–40	1–74	1–127	1–72
Has sparse memory matrix to conserve RAM	●	●	●	●	●	●	●	●
Database can be larger than spreadsheet	●	○	○	○	○	N/A	○	●
Uses expanded memory	●	●	○	●	●	○	○	○
Uses math coprocessor	●	●	○	●	●	●	●	●
FUNCTIONS AND FORMULAS								
No. of math/logic/financial functions	28/8/8	17/7/11	40/10/4	16/16/18	17/5/9	17/7/14	20/11/14	9/3/5
No. of date and time functions	8	11	2	9	43†	11	12	14†
No. of statistical string functions	2/19	14/11	6/0	15/0	15/0	7/18	8/2	7/13
No. of logical and arithmetic operators	12	15	15	12	13	17	11	14
MACRO CAPABILITIES								
Has learn mode for macros	○	○	●	●	●	●	○	●
Can run 1-2-3 macros	○	●	○	●	○	○	○	○
Macros reside in worksheet/ library	●/●	●/○	○/●	●/●	●/○	○/○‡	●/●	●/●
MISCELLANEOUS								
No. of split screens	2	2	4	2	2	None	2	2
Split screens scroll/format independently	●/●	●/●	●/●	●/●	●/○	○/○	●/●	●/○
Cursor keys enter cell data	○	●	●	●	●	●	○	●
Can back-step through previous commands	○	●	●	●	●	●	○	●
Hides columns/rows	●/●	●/○	●/●	●/●	●/●	●/●	○/○	○/○
Hides individual cell contents	●	●	●	●	●	●	○	○
Has cell protection	○	●	●	●	●	●	●	●
Formats cells to display numbers as words	○	○	○	○	○	○	○	○
Can merge contents of spreadsheets	●	●	●	●	○	○	●	●
Can import/export 1-2-3 files	●/●	●/●	●/●	●/●	●/●	●/●	●/○	●/○
Warns against file overwrite	●	●	●	●	●	●	●	●
No. of graph types	6	5	5	7	6	None#	5	8
Has context-sensitive help	○	●	●	●	●	●	●	○
Does recalc in logic order	●	●	●	●	○	●	●	●

with full-screen looks at a section of a spreadsheet. †Tab key replaces left and right cursor keys. Up and down cursor keys work the same way as in 1-2-3. #Uses separate program to produce graphs.

THE NEVER ENDING STORAGE.



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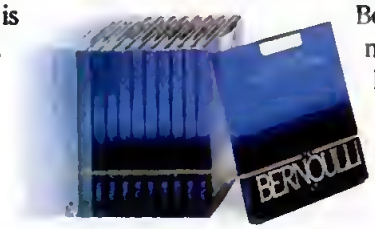

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Products that display this logo are compatible with Bernoulli products.

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CIRCLE 378 ON READER SERVICE CARD

copyright notice? (See "Special Report," *PC Magazine*, Volume 6 Number 10.)

More recently, a clearly legitimate form of competition has come from programs that maintain just enough compatibility with *1-2-3* but offer features that go well beyond it. *Silk*, *SuperCalc4*, *PFS:Professional Plan*, and the 12 others reviewed in this issue can make plausible claims to being better spreadsheets than *1-2-3*. True three-dimensional programs, such as *microCUBE*, operate in a dimension that *1-2-3* has never even heard of. Microsoft's *Excel* for the PC and a powerful spreadsheet by Borland International, both scheduled for release this fall, will only heat up the competition. Lotus is already responding to the competition with a new release of *1-2-3* scheduled to appear in 1988 (see sidebar "Spreadsheet Contenders Put Pressure on Lotus"). At the low end of the spectrum are a wealth of mini-spreadsheets, such as *PFS:First Choice* or Buttonware's *PC-Calc*, which lack the power of traditional spreadsheets but offer handy, easy-to-use solutions to many business problems. We directed this set of two reviews at both kinds of Lotus challengers: programs that take on *1-2-3* feature for feature, and 3-D spreadsheet programs—those that bind together worksheets like an electronic book in which every page analyzes the detail from the page before.

OS/2 AND BEYOND Nevertheless, the real challenge to *1-2-3* isn't likely to come until OS/2 is firmly established. Huge investments in data and training, as well as pure force of habit, make the *1-2-3* standard all but impossible to budge. People won't abandon it until the vast new powers of a new operating system make them revamp their entire computing base.

The new operating system will let the 80286 address 16 megabytes of RAM and huge amounts of virtual memory. The 80386 opens up even broader horizons. Multitasking and intertask communications will become routine. This leap in brute computer power is far greater than the jump from 64K to 640K bytes of RAM. Ambitious software developers are drooling at the prospect of writing programs to use all that power.

Spreadsheets written for OS/2 will do things we haven't yet thought to ask for. They will be designed by people whose minds aren't prisoners to the conventions of rickety old MS-DOS. No one can say who will rule the spreadsheet roost 5 years from now. But for the first time since 1982, there's a chance it might not be *1-2-3*.—**Jared Taylor**

Multiplan

It is sad to see a company as prominent as Microsoft Corp. let a product slide into obsolescence, but that's what seems to have happened with the company's $195 spreadsheet, *Multiplan*. *Multiplan*, Version 3.0, has no graphics or database, which might be OK if nothing else were available, but the spreadsheet market is crowded with packages that have more to offer.

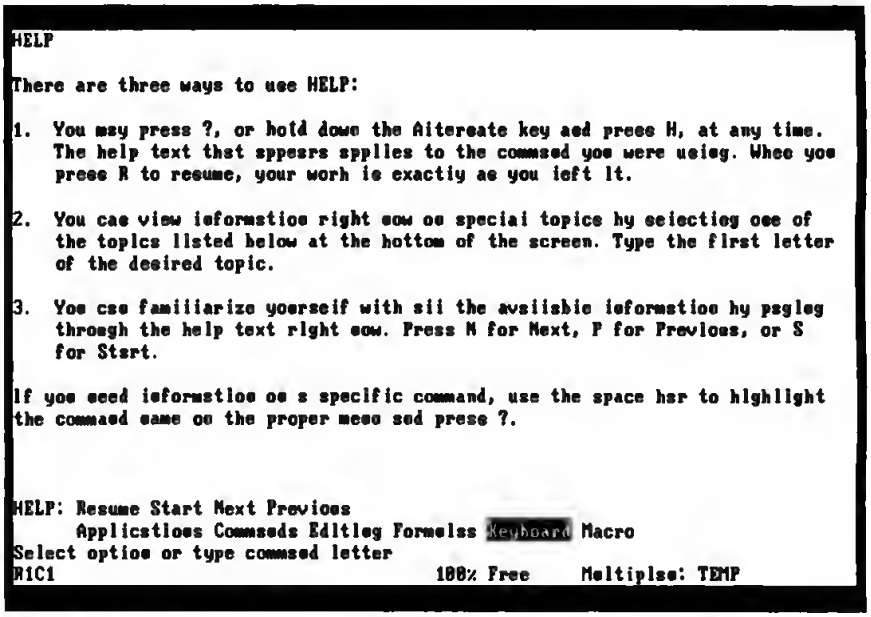
This October, Microsoft is scheduled to release *Excel*, a powerful new spreadsheet that was previously available for the Macintosh. *Excel* is targeted at the 80286 and higher market. *Multiplan* will continue as Microsoft's mainstay in the 8086 market and in the overseas market, where, the company asserts, it outsells *1-2-3*. A company spokesman said that, while Microsoft will continue to support *Multiplan*, no new versions are under development.

In our tests, *Multiplan* showed itself to be a product of old technology. It is hard to list all of its deficiencies. But at a list price of $195, *Multiplan* is much cheaper than many other spreadsheets.

The documentation includes no keyboard overlay, nor even a keyboard diagram. There is a list of functions by topic buried in the middle of the book, but since the quick-reference guide is alphabetical, you can't find a function unless you already know its name. The index is decent, but using the document was extraordinarily frustrating. Time and again you are told "see XXX in Chapter YY," but none of the cross-references had page numbers!

CRYPTIC PAGE NUMBERS Pages in the introduction are numbered in Roman numerals, so the index refers to cryptic locations like "xxxiii." We can figure out what it means, but why put anyone through the agony? It's not as if there was any shortage of Arabic numerals.

Multiplan identifies cells by "RnCm" for "Row N, Column M." Referring to the first cell in the sheet takes four characters, R1C1, instead of the usual A1. Relative cell references are even more long-winded. Instead of the simple cell refer-



Multiplan's help screens can be confusing. The Enter key can select the menu but the ? key cannot. The keyboard selection highlighted at the bottom was chosen by hitting the Spacebar.

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BYTE, March 1987

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Monographic System Basic system with option Monographic board and monitor	*$1320*	*$995*
Color System Basic system with option color board and monitor	*$1496*	*$1426*

QIC 286 System

Monitor not included.

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with option ***$1026***

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Basic System: 512K expandable to 1MB, two 8-bit and six 16-bit slots, clock/calendar with battery backup, 192 watt power supply, AT™ style keyboard, complete 200 page manual.

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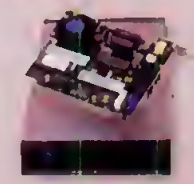
Seagate ST251 40MB (1/2 Ht, 40ms) ***$629***
NEC D5146H 40MB (1/2 Ht, 40ms) .. ***$499***
Seagate ST4096 80MB (28ms) ***$1095***



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Quality HD Kit comes with controller, cable, manual, software and mounting screws.

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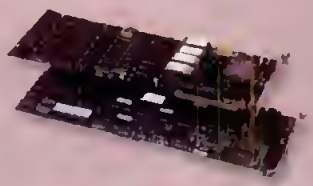

Monitors

- **Monochrome** ***$109***
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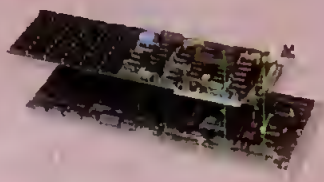
- **EGA Monitor** ***$449***
- **NEC Multisync** ***$579***



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  640 x 480, 16 colors EGA mode, 720 x 348 monochrome mode, 640 x 200 16 color RGB mode, Hercules 132 column.
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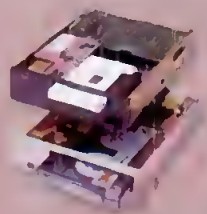
  720 x 348, Hercules compatible, printer port.
- **QIC Monographic with i32 coiumn** ***$109***
- **Professional Graphic Adapter** ***$995***
  640 x 200, 2 colors CGA mode, mono Hercules mode 720 x 348, PGA mode 640 x 480, 256 color.



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  Holds up to 2MB, parallel, serial and game port, set-up software.
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PC MAGAZINE FACT FILE

***Multiplan*, Version 3.0**
Microsoft Corp
16011 N.E. 36th Way
Box 97017
Redmond, WA 98073
(206) 882-8089
List Price: $195
Requires: 256K RAM, one floppy drive (two recommended), 80-column monitor, DOS 2.0 or later.
In Short: A product of old technology with habits that can be annoying to power users. Not copy protected.

CIRCLE 692 ON READER SERVICE CARD

ences that you find in *1-2-3* and others that follow the standard, *Multiplan* gives you things like R[-1]C[-1], which refers to the cell immediately above (R[-1]) and to the left (C[-1]) of the current cell. *Multiplan* does, at least, let you identify cells by moving the cursor so you don't always have to type those interminable references. It is handy to be able to identify an entire row at once by saying "R1," but Lotus's notation is considerably more compact, even when you include the @ in front of every function name.

Besides using arrow keys for cursor movement, *Multiplan* accepts Ctrl-E for up, Ctrl-X for down, Ctrl-S for left, and Ctrl-D for right. These keys follow the typical cursor layout with Up at the top, Down at the bottom, and so on. This follows the Cursor Diamond convention that is also found in *WordStar* and *dBASE*. It can be handy for persons who are used to working with those programs, although it may be a bit awkward for the uninitiated.

Multiplan lets you divide the screen into as many as eight windows and examine a different spreadsheet in each one. Unfortunately, *Multiplan* checks your CONFIG.SYS to make sure it can open that many files and will not even start unless the FILES = parameter is big enough. How big is big enough? The error message does not say. FILES = 10 is not enough because the program won't start; the documentation claims you need at least FILES = 20, but our version started with FILES = 15. The error message should be a tad more specific and tell you how much to increase your Files parameter.

Multiplan is a split-screen spreadsheet with macros. You can sort on one field at a time and search. Nothing in *Multiplan* is as powerful as *1-2-3*'s database facilities, and there are no graphics.

Multiplan is a lot cheaper than *1-2-3* and somewhat cheaper than many of its betters, but there are still *1-2-3* clones out there that sell for half *Multiplan*'s $195 list price. If price is your main concern, you'd be better advised to go with one of them.
—William A. Taylor

1-2-3

For better or for worse, Lotus Development Corp.'s *1-2-3* is the standard by which other spreadsheets are measured. Reviewing it is therefore like describing the length of a mile. It's tempting to say that *1-2-3* is an expensive but fully Lotus-compatible, copy-protected spreadsheet, and leave it at that. For many readers, that's a full description. For those for whom it's not, a few supplementary paragraphs follow.

Lotus's *1-2-3*, at its list price of $495, is an excellent electronic spreadsheet that incorporates useful but limited database and graphics capabilities. It is a single-user program that can run on single-floppy systems, as well as on more-powerful machines. If you have Lotus/Intel/Microsoft (LIM) specification expanded memory, it can use more than 640K bytes of RAM, and you can expand its capabilities with add-in programs. It is the world's most popular applications program. It has sold more than 3 million copies in the second quarter of this year alone.

Unlike some newer programs that can be configured from within the program, *1-2-3* requires a specific installation step. Installation is not difficult, though, and is clearly explained in the manual. *1-2-3* uses key disk copy protection, but you can install Release 2.01 on a hard disk so that it will load without the floppy.

You bring up the top-level *1-2-3* command menu by hitting the Slash key (/). Choices appear as single words in the second line of the control panel at the top of the screen, with the first choice highlighted. The third line of the control panel displays information about each choice. This is either a one-line explanation of what the command will do or a list of additional choices in the menu at the next level. You make a choice by highlighting the menu item with a cursor key and hitting Enter, or by typing the first letter of the word. Typing the letter is usually quicker. This style of menu has been very successful and is widely imitated.

Some top-level menu choices lead to many levels of submenu, so a command from the Ready state can be long. For example, to set the bottom print margin to 5 rows and return to the Ready state, you'd enter

```
/ppomb5<Enter>qq
```

At every step of the way, the command menu displays your choices. If you need instructions, you get good, context-sensitive help by hitting F1.

LOGICAL COMMANDS When you enter data into cells, the program automatically distinguishes between text and numbers. You can move data around, copy it, and format it in many convenient ways. Commands for these common operations are invariably logical and easy to use.

To build a spreadsheet, you set up relationships between different numbers or values in different cells. The links between cells are standard mathematical operators and special, built-in functions that must be identified with a leading at-sign (@). There are nearly 90 @ functions—statistical, financial, logical—and so forth—and you can combine them within formulas to make very complex and sophisticated

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***1-2-3*, Release 2.0**
Lotus Development Corp.
55 Cambridge Pkwy.
Cambridge, MA 02142
(617) 577-8500
List Price: $495
Requires: 256K RAM, one floppy disk drive, DOS 2.0 or later.
In Short: The industry-standard electronic spreadsheet, with limited database and graphics. Copy protected.

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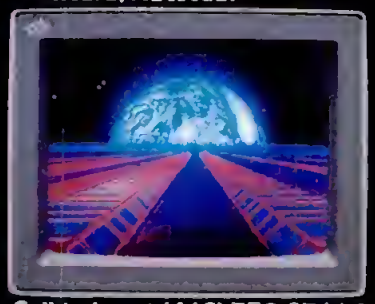

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It's true. With @LIBERTY (pronounced "At Liberty") you'll finally be able to distribute executable spreadsheet applications—as many as you need, to anyone who needs them. Simply. Securely. And very inexpensively.

That's because @LIBERTY is the first-ever spreadsheet compiler. It works by separating the task of spreadsheet development from the task of spreadsheet usage. As a result, you can convert your spreadsheets into "runtime" versions. In English, this means you can create executable 1-2-3 files that run on IBM-compatible PCs—and your users won't need a copy of the original spreadsheet package.

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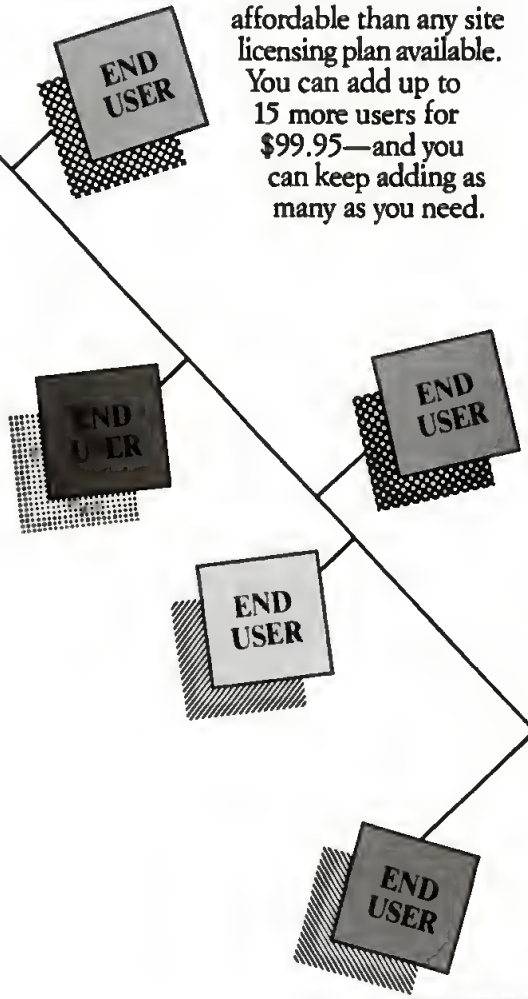

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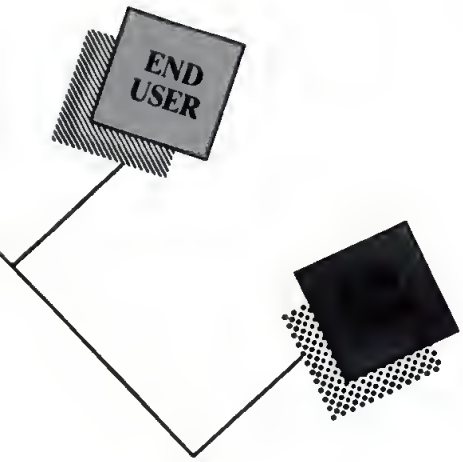
6



@LIBERTY

1-2-3 is a registered trademark of Lotus Corporation.

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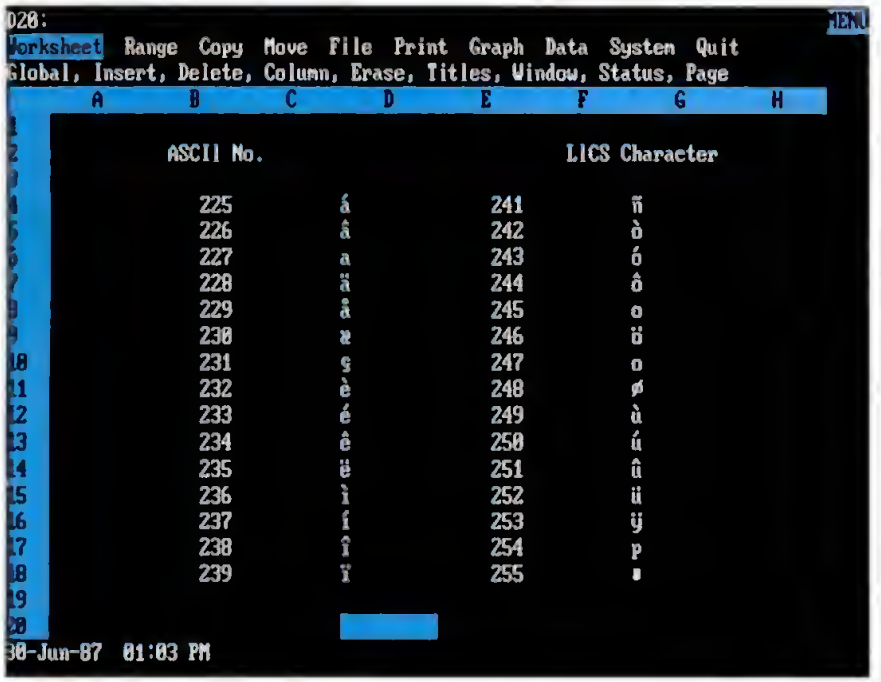


In its normal configuration, 1-2-3 *displays what it calls the Lotus International Character Set (LICS) instead of the usual high-bit ASCII characters. The top three lines are the control panel, in which the main slash-command menu appears.*

mathematical models. Some @ functions operate on text strings, so *1-2-3* formulas can work with words as well as numbers.

1-2-3's editor for cell entries is reasonably good. You can move to the first or last characters in a cell with Home or End, and you can move right or left five characters at a time with Tab or Shift-Tab. Cell contents needn't be formulas. They can be lines of text, which can be printed or stored as ASCII files on disk. Thus many people who work frequently with *1-2-3* find themselves using it for simple word processing.

With numeric data, you can use *1-2-3* to draw graphs. There are only five graph types—line, bar, *x-y*, stacked-bar, and pie—and the program does not give you much control over their appearance. If you print a graph, you have more choice over the size of the graph, as well as colors and text fonts. However, in order to print, you must save the graph to disk and then run a separate PrintGraph program that sends the image to a printer or plotter.

You can organize *1-2-3* data handily into simple databases. Each record is a single row of the spreadsheet, and different cells in the row are different fields. You can sort records by two keys at a time in ascending or descending order, alphabetically or numerically. You can search for records according to elaborate mathematical or logical criteria, and either copy the matches to a blank part of the worksheet or have the cursor go to them.

Other sophisticated data commands let you determine data distributions, which show the frequencies of certain values, or do regression analysis. You can also invert or multiply square data matrices and build data tables that show the results of changing one or two values in a formula.

1-2-3's databases are convenient, but their size is limited by the amount of memory in your computer. This is because searches and sorts can be done only on data in a single spreadsheet, and the spreadsheet must fit in memory.

One of *1-2-3*'s great strengths is its powerful, built-in macro language. The language not only automates routine keyboard chores, it's a programming language you can use to write full-blown applications. The language can make logical decisions, branch, loop, prompt users for input, open and write disk files, call subroutines, and pass arguments to them. Even experienced *1-2-3* users are constantly finding powerful new ways to use the language.

LANGUAGE BARRIER One of the most common complaints about the language, though, is that macro routines must operate from within the spreadsheet currently in memory. If they could operate from a macro library on disk, they could manipulate multiple spreadsheets more easily.

1-2-3's great popularity has spawned an accessories industry. You can buy independently written programs that compact your files, change the colors on your screen, troubleshoot your spreadsheet, or let you attach explanations to spreadsheet cells. There are also macro templates, for free or for sale, that turn *1-2-3* into a tax program, real estate analyzer, general ledger, or whatever. Also, since so many people know the program, it's easy to find help if you need it.

Recently introduced add-in programs let you attach special capabilities to *1-2-3* and use them almost as if they had always been there. There are word processing, linear programming, and goal-seeking add-ins, with more to follow.

Since its introduction in 1983, *1-2-3* has been substantially updated only once. In 1985, Release 2.0 brought us a larger, better-designed spreadsheet, as well as a greatly improved macro language. However, not all changes have been improvements. The original release came with an excellent disk-based tutorial that was replaced by a strictly passive *View* program. Release 2.0 started out with the serious reference material in a separate and very handy paperback book that fit on any bookshelf. When the debugged and slightly improved Release 2.01 appeared, the reference material was back in with everything else, in an unwieldy ring binder. You win some and you lose some, but the personality of *1-2-3* hasn't changed.

Newer spreadsheets offer powerful features *1-2-3* doesn't have. However, its limitations are often more than made up for by *1-2-3*'s overwhelming acceptance and support. Buying *1-2-3* is like buying IBM: there may be a better product out there, but you can't go far wrong with the industry standard.—**Jared Taylor**

PC/Foccalc

PC/Foccalc, a $495 spreadsheet add-on from Information Builders, makers of the *Focus* and *PC/Focus* database programs, is a private-label version of the mainframe and micro spreadsheet, *20/20*, from Access Technology. *PC Foccalc* has some particularly attractive features, some of which come from *20/20*, and others that are due to its integration with *Focus* itself.

We say "*Focus* itself" because, in fact, versions of *Foccalc* run both on mainframes and on micros, as does *Focus*. To put *PC/Focus* into perspective is important because its position in the PC database market is not generally known outside of the mainframe community, which uses its big brother. Sales are direct to corporations and as a result are not generally reported, but *PC/Focus* is second in dollar volume only to *dBASE*. Thus the prospect of integrated spreadsheet/database functionality is very attractive to a large (tens of thousands) audience of corporate power users.

PC/Foccalc can be accessed only from within *Focus*. This is a weakness, because the program is certainly attractive enough to stand on its own. If you don't need the *Focus*-dependent functions, you should certainly consider *20/20*. However, *PC/Foccalc* gives the user who is comfortable with the spreadsheet metaphor a spreadsheet-style view into *Focus* databases, as well as into many other data types via the integration of the two products.

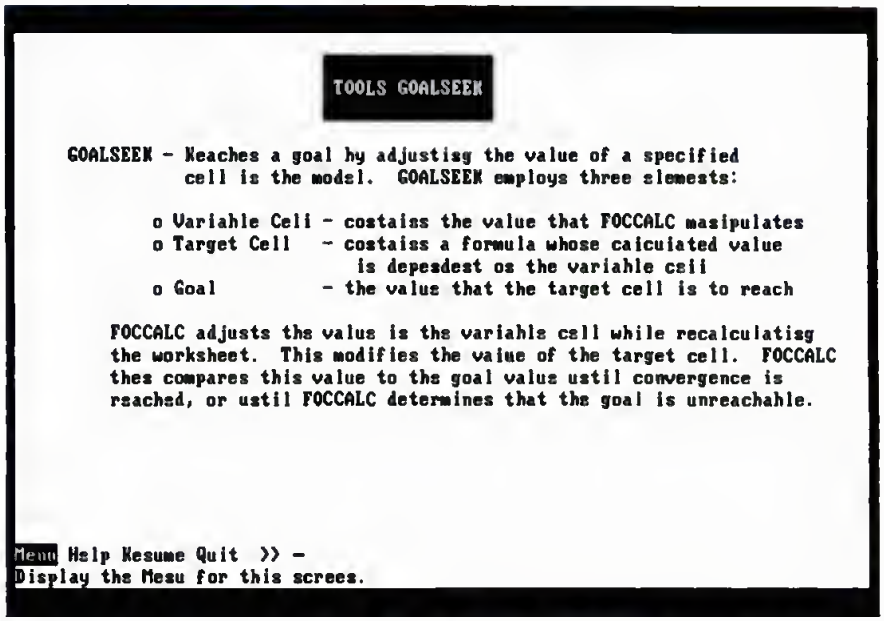
The interface is Lotus style: the Slash key invokes the two-line Lotus-style menu bar, and many of the same functions are available with similar syntax, such as using the @ for function identification and the $ for absolute cell references in formulas. By placing labels in row or column 0, you can create range names like *1-2-3*'s and refer to cells by name with the $, which fixes them as well. You can end a "Point mode" definition of a range by entering $, or you can use R to fix rows or C to fix columns.

Still, there are significant differences from *1-2-3*. For example, numbers and not letters are used for column identification. The pairs are enclosed in square brackets rather than parentheses; the brackets are required only within functions. This is actually quite useful; it's often easier to decipher [7,53] than (7,BA). In addition, the use of parentheses for expressing computational priority is much clearer if cells are identified this way. If you imagine typing

```
(@SQRT[3,8]+@SUM-|5..17,2])*@TAN[8,34]
```

exclusively with parentheses, you get the point. It is a little easier on the eyes, and it doesn't take long to get used to it.

There's a tutorial that gives a generally useful introduction to a number of fundamental concepts such as Point mode and absolute references. (The latter is nicely implemented. You are allowed to conclude pointing by typing $, which makes the references absolute, as it does in *1-2-3*.) Another well-handled element in the tutorial is goal seeking, which is effectively demonstrated by using an IRA as an example. After constructing the spreadsheet and learning a number of functions along the way, you can use goal seeking to determine what it would take to have, say, $50,000 after 10 years at varying rates of interest and principal contributions.



The Goal Seek function of PC/Foccalc *is a very powerful tool; the help screen that explains it is generally narrative and quite useful.*

EASY LINKING Spreadsheets may be linked with ease. You can construct a consolidation model—a very powerful tool that can be used to produce consolidated income sheets, divisional summaries, annualized or year-to-date data; the list goes on. In addition to Lotus-style File Combine additions and subtractions of spreadsheets, *PC/Foccalc* can perform multiplication, division, and comparison-based (greater or less than) merges.

Perhaps *PC/Foccalc*'s most powerful feature is its integration with *Focus*. *Focus*'s query language permits retrieval of data from a file with a phrase like "Print sales and cost and compute margin = Sales − Cost if region is NY." *PC/Foccalc*'s power becomes evident when you realize that you can embed one of these

PC MAGAZINE FACT FILE

PC/Foccalc
Information Builders Inc
1250 Broadway
New York, NY 10001
(212) 736-4433
List Price: $495
Requires: 640K RAM, hard disk, DOS 2.1 or later.
In Short: A powerful, flexible spreadsheet but highly complex and not recommended for the quick-and-dirty project. Copy protected.

CIRCLE 690 ON READER SERVICE CARD

SAY SAYONARA TO SYMPHONY WITH 1-2-3 ADD-INS

It's no news, certainly, that people have been doing weird and irrational things with *1-2-3* for a long time. Like writing memos (chuckle) by stacking up lines of text in Column A. And actually using *1-2-3* as a (giggle, snort) database.

And we shouldn't be surprised. Lots of people do lots of strange things, from jumping off tall buildings wearing parachutes to diving among great white sharks on Australia's Great Barrier Reef. They, too, usually survive—if only slightly less bruised and battered than those who use *1-2-3* as a word processor or database manager.

Now, though, that kind of eccentric behavior at the PC is being legitimized by the small flood of add-ins appearing for *1-2-3*. Indeed, Computer Associates has validated the concept by beginning its own line of add-ins for *SuperCalc4*.

From Lotus's side of the ledger, building the add-in capability into *1-2-3* (Release 2.0 and later) is a masterstroke. It helps further establish *1-2-3* as the corporate computing standard. It extends the franchise, without litigation, of Lotus's moving-bar menus. It opens opportunities for other developers while simultaneously entrenching Lotus: you've gotta have *1-2-3* to use *1-2-3* add-ins, natch. And at least in Lotus's view, it relieves the company of the burden of having to develop some features that should have been in *1-2-3* since at least Release 1A* (which superseded Release 1A until 2.0 came out).

It's not bad from the *1-2-3* user's side, either. A lot of corporate PC users never use anything *but 1-2-3*, so it's natural that they've been trying surreptitiously to bend it to their word processing and database needs. Now they can do so with a smile and without apology to anyone, because some of these add-ins are very, very good indeed.

Increasingly, business users of *1-2-3* (is there any other kind?) have been using the program as a platform, or engine, for work that may well be finally presented by, analyzed in, exported to, or imported from another program. *1-2-3* is becoming the standard target for downloaded data from mainframes, for example. And it works two ways: *1-2-3* graphs, feeble as they are, are the starting point for exports to many *Freelance Plus* and *Harvard Graphics* presentations.

So why not stretch that platform into a complete operating environment? Finally *1-2-3* really has become the kind of context-switching universal "operating environment" that many business people have shown they want. And just in time, before the *Windows/Excel* juggernaut comes over the hill.

SIMPLE IDEA The idea behind *1-2-3* add-ins is simple: you never leave the Lotus worksheet environment. Hit Alt-F10 to bring up *1-2-3*'s own Add-In Manager, then A for Attach, then Alt-F7, F8, or F9, depending on which add-in you want to use, and you're in a program-within-a-program that, depending on the developer's skill, looks somewhat to very much like Lotus. You can even selectively unload add-ins to reclaim memory.

Among the early *1-2-3* add-ins, several are outstanding. A whirlwind tour:

Turner Hall's *4Word* is a good, utilitarian word processor on the memo-writing level. Since it stores its text inside the *1-2-3* worksheet, you can read (if not print very well) the contents of a *4Word* text block in a *1-2-3* worksheet file that has been given to you on disk (or sent to you on a network), even if you don't have a copy of *4Word*.

WriteIn, from Blossom Software, is even better still, if what you want is an almost-full-featured word processor instead of a memo writer. *WriteIn* even has a miniature style sheet feature, reminiscent of *Microsoft Word*, for speed and consistency in formatting documents. Because it stores its files *outside* the worksheet, you can't accidentally overwrite anything in the rows-and-columns matrix, which is easy to do in *4Word*. You choose the approach you like.

In databases, Informix has a product that at first seems ludicrous: the *Informix Datasheet Add-In*, an SQL-compatible fully relational database front and back end, which lets you create, query, and spec reports from a Lotusy front end, within *1-2-3*, while using the *WriteIn* trick of storing the data files themselves outside the worksheet.

Who wants an industrial-strength SQL database nested inside *1-2-3*? A lot of people, I'll bet, who work with Informix's 4GL and SQL mainframe products, as well as other vendors' SQL-query programs, and who sometimes want to build and use their own PC-resident databases within the familiar confines of *1-2-3* and the familiar context of SQL.

In the same vein, Personics offers *@BASE*, a *1-2-3* add-in that reads *dBASE III* files and extends *1-2-3*'s analytical powers to the data in those files. You can, for example, create a *1-2-3* worksheet from a selected subset of a *dBASE* database, then use *1-2-3*'s native tools to sort, count, sum, and otherwise manipulate those rows and columns, then do a quick *1-2-3* bar graph of your column footings.

ANOTHER WINNER Personics has another winner in *SeeMORE*, which, in addition to its splendid if misspelled name, finally gives *1-2-3* users easy access to EGA video cards' and monitors' ability to squeeze more than 76 columns and 20 rows of spreadsheet data onto the screen. (The rest of the usual 80 by 25 display is consumed by *1-2-3*'s menus, status lines, and row-and-column identifiers.)

With *SeeMORE*, you can get up to 124 columns by 38 rows of small but legible type on an EGA or VGA display, or up to 156 columns by 53 rows of tiny, threshold-of-legibility characters if you're willing to risk eyestrain. (With a Hercules card, you can get up to 176 columns by 53 rows.)

Both Turner Hall and Funk Software offer cell-annotation add-ins. *Note-It Plus* brings Turner-Hall's existing *Note-*

It inside *1-2-3* and enhances its features; Funk's *Noteworthy* takes a new approach, with some familiar word processor features such as block copies and moves, as well as search and replace (only with notes, not *1-2-3* data, unfortunately).

Intex Solutions has brought a laserprinter setup add-in, *JetSet*, to market, and now *3D Graphics*. The latter is no match for an external, dedicated 3-D presentation-graphics program such as *Perspective*, but it is a very useful adjunct to the analytical-level graphing powers of *1-2-3* itself.

Many more add-in products have been announced, and some actually delivered. More are coming this fall.

Developing the add-ins facility may have been a defensive move for Lotus, an effort to hold the fort against *Excel*—since programs running under *Windows*, such as *Excel*, can easily swap data and even swap themselves in and out of the user's "live" window.

But by developing a mechanism to graft add-ins onto its lead product, Lotus has so extended the reach and convenience of *1-2-3* as to have redefined its role for many users. Forced to choose between changing to a new spreadsheet product, climbing another learning curve, then adding still more new products and learning *them* versus simply extending their use of *1-2-3* through familiar-looking (and inexpensive) add-ins, many *1-2-3* users are going to stay firmly tucked into Lotus's hip pocket. And very comfortably so.

The real loser in this won't be those competing spreadsheet products, which will attract plenty of buyers interested in their special features, but Lotus's own *Symphony*, a nice spreadsheet with incredibly feeble word processing, database, graphics, and communications modules more or less built in. The old bag lady's surely done for. Lotus has promised another upgrade sometime early in 1988, but after that we can expect to see *Symphony* shuffle offstage, the victim of *1-2-3*'s better idea for adding-in functionality.—**Jim Seymour**

queries, or report requests, at levels of significant complexity, within a cell of the spreadsheet and have the results automatically populate the appropriate range of the spreadsheet with the /Focus Current command. If the report or query has been stored as a *PC/Focus* procedure, it can be invoked by name with the EXEC procedure Name command. A RECALC (invoked with the Spacebar) will execute the query. What-ifs can become what-nows and can be moved to a call location that is specified in the command. Add goal-seeking and dependencies to other linked spreadsheets, which may also contain such references in other files, and the potential is enormous.

The spreadsheet does not depend exclusively on the use of *PC/Focus* for database operations, however. One-key data sorting is possible, and data table operations can be performed. The Tools Database selections include Sort, Find, Extract (Find plus Copy), and Operate (Find plus some computation or statistics on the result). The level of logic support here is particularly impressive. By first evaluating a logical operation and then selecting based on the field that holds the return value, you can put together a procedure within the spreadsheet that functions as a selective query report operator.

REPLAY FEATURE In complex operations such as these, the Replay feature is a great asset. *PC/Foccalc* remembers your last sequence of keystrokes in Tools Database Select mode and lets you replay it, changing only the target field that will hold the results.

PC/Foccalc's graphics are reasonable, although hardly overwhelming. Device drivers are available for HP plotters and the common printers. If you wish, you can split spreadsheets four ways with the /Window command and place the graphics in a particular window. The full range of formatting options is available.

Macros are handled differently from those in *1-2-3*. They're called command files, and they're stored outside the spreadsheet itself. Every keystroke that can be entered can be duplicated with macro commands. The syntax is no more attractive than Lotus's, unfortunately, but it seems a little shorter: #U is used for {UP}, for example. There's a Quiet mode that suppresses screen display of the executing command file, and you can comment on the procedures. There is no Learn mode as yet—a major failing, but a common one. (In *1-2-3* you can get the mode if you buy *HAL*.)

Import and export capabilities are interesting but limited. There is no provision for Lotus import or export, and none for .DIF files. You can handle delimited files (.CSV is one example), though. Numbers, text, and command files can be moved in and out as well. If you select Export Data, you are prompted for the delimiter you want; one is placed between fields, and two at the ends of lines.

In *PC/Foccalc*, macros are handled differently from those in *1-2-3*. They're called command files, and they're stored outside the spreadsheet itself.

The number of available functions is impressive: four financial, nine math (plus seven trigonometric), as well as statistics, logic, lookups, date functions, and others. There is no string handling, though, other than the ability to count labels within a range. Given that the basic technology belongs to Access, it's hard to predict support for such things as extended memory, extended graphics and additional device drivers, better file import/export, Learn mode, and so on, but even with these omissions, *PC/Foccalc* is a very impressive offering. It's difficult to imagine passing up its power if you're a *Focus* user, and if you're not, it's just another reason to look at one of the premier families of software products available in the DBMS area.—**Merv Adrian**

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8 0 0 · 4 2 6 · 5 1 5 0

AUSTIN, TEXAS

CIRCLE 539 ON READER SERVICE CARD

PFS:Professional Plan

Software Publishing Corp. was one of the first software companies to successfully market inexpensive packages for the PC. The *PFS* series (*File, Report, Write*) was very successful, but as PC users matured, so did their software needs. Software Publishing has recognized the changing market and produced the *PFS:Professional* series, a more full-featured set of packages aimed at the new market. *PFS:Professional Plan*, which lists for $249, is Software Publishing's spreadsheet offering in the series.

Unlike *1-2-3*, *PFS:Professional Plan* isn't copy protected. You can quickly install its two program disks onto your hard disk by using DOS's COPY command. *Plan* greets you with a menu where you tell it whether you want to create or edit a spreadsheet, set up hardware parameters, or exit *Plan*. Hardware setup is simple, with menus leading you through changes in the screen and printer choices.

Create/Edit brings you to the familiar spreadsheet cell structure. *Plan* follows the same bothersome convention of cell references found in Microsoft's *Multiplan*. Unlike *1-2-3*, where columns are labeled with letters and rows with numbers, *Plan* labels its rows R1,R2 and its columns C1,C2, so that getting there requires double the number of keystrokes. Individual cells are referenced as R1C1, R2C2, and so on. The manual tells us that *Plan* also uses "the IBM standard for cursor movement keys," which really isn't so standard to spreadsheet veterans who cut their teeth on Lotus. The IBM standard moves the left arrow one character to the left rather than one cell to the left, as *1-2-3* does. Similarly, the tab moves one cell to the right, rather than taking you a full screen to the right, as *1-2-3* does. This may not bother novices, but it's a sizable pain to practiced spreadsheet users.

	C1	C2	C3	C4	C5
		January			
	Actual	Quota	% Dif	Commission	
R1	Berkeley District				
R2	Joe Adams	$39,590	$40,000	-1.03%	
R3	Stephen Dunn	$47,200	$42,000	12.38%	
R4	Jennifer Smith	$38,800	$47,500	-18.32%	
R5					
R6	Total Berkeley	$125,590	$129,500		
R7	% W. Region Sales	17.6%			
R8					
R9					
R10	Oakland District				
R11	Dennis Johnson	$36,950	$37,500	-1.47%	
R12	Janice Hart	$45,200	$40,000	13.00%	
R13	Kevin Reeves	$41,848	$38,500	8.70%	
R14					
R15	Total Oakland	$123,998	$116,000	6.89%	

Cell name: Cell formula:

sales87.tid 13% Full R4 C2 R4 C2 ↵ Accept

PFS:Professional Plan *requires you to enter formulas from a menu or use Ctrl-F to display the dialog box shown here. Cells are referenced by row and column numbers or by row and column titles, such as (ACTUAL-QUOTA)/QUOTA.*

Where you would find the second line of a two-line menu at the top of *1-2-3*'s screen, *Plan* lists seven function keys and tells you what they do. F1, for instance, calls up detailed context-specific help. The other function keys display pull-down menus that lead you through such things as formatting and copying. You can use the F keys, select the function from the menu using cursor keys, or access the function with a Ctrl-key combination, such as Ctrl-S for save.

Labels and numbers can be typed directly into a cell. The column widths expand automatically to match the widest entry. Cells are five spaces wide, and when you reach the sixth, the margin scoots to the right. To enter a formula you must select F4, Formulas, or use Ctrl-F to enter your information in a dialog box. You can use cursor movement keys to build formulas, but you must type a Ctrl-W each time that you want *Plan* to note the current cell location. *Plan* also contains many of *1-2-3*'s @ functions and a few of its own, although a number of them do what can easily be accomplished in *1-2-3* with formulas.

Each spreadsheet has special regions for column headings and row titles. You can use entries in this region as names in the spreadsheet, and formulas can be attached to these names so that they affect the entire row or column. For example, a cell in the title region next to row 2 that is labeled "Cost of Sales" can contain a single formula, "Sales *.5". All columns with a formula heading will be replaced with the calculated value of that formula using the figures from the row that has the title "SALES, row 1," in it.

CIRCUITOUS COMMANDS Copy and Move commands are more circuitous in *Plan* than they are in *1-2-3*. It will take you

FACT FILE

***PFS:Professional Plan*, Version 1.0**
Software Publishing Corp.
1901 Landings Dr.
Mountain View, CA 94039
(415) 962-8910

List Price: $249

Requires: 512K RAM, two floppy disk drives (hard disk recommended), DOS 2.0 or later.

In Short: A nice complement to the *PFS:Professional* series, matching *1-2-3*'s features but not its style. Nice for the novice but annoying to power users. Not copy protected.

CIRCLE 689 ON READER SERVICE CARD

a bit of practice to execute them properly. To copy a single cell, you select Ctrl-C for copy, move the cursor to the first point of the copy, type Ctrl-X for mark, cursor over to the end point, and type F10 to finish the copy. To copy a column, you first mark the column, then select Ctrl-C to copy, mark the destination, and type F10.

Where *1-2-3* gives you window, row, and title locking, *Plan* gives you a View capability that is more powerful than *1-2-3*'s approach but, again, different enough from *1-2-3* to be irritating to power users. In View, you can display any rows or columns, contiguous or not, without changing the look of the original spreadsheet. To specify a view, you select the menu choice and put a "+" above the column or to the left of the row to identify the items that are to be shown in the view. In the same areas where you place the +, you can specify sort sequences and reorganize the view, again without changing the original spreadsheet.

Plan lets you print the entire spreadsheet or print a specific view in which you tell the program which columns or rows to print. This feature gives you more flexibility to customize printed reports than you get from *1-2-3*. Printer codes, headers and footers, and other features are handled in *Plan*'s print routine.

Unlike *1-2-3*, macros are stored in a separate file and executed like a batch file. You can create macros by recording keystrokes or by using the macro editor, a mini word processor. You simply type them as you would a document, and *Plan* writes them to disk rather than to the cells as *1-2-3* does. The macros look like a structured programming language and can execute all commands from pull-down menus. Macro names can be Alt-A through Alt-Z and Alt-0 through Alt-9. *Plan* doesn't give you as many macro keywords as does *1-2-3*, but the list is more than adequate.

GOOD WITH GRAPHS *Plan*'s graphics abilities go one step further than do *1-2-3*'s. Graph definitions appear in clear, simple screens, and the data itself is selected in a special area that's similar to the View selection. You can create pie, bar, area, and high/low charts, each with a variety of options, and print from the same program using one of four fonts in three sizes: small, normal, or expanded. The process is certainly less cumbersome than *1-2-3*'s, which requires that you to go to a "print graph" program.

Plan supplements its on-line help with meticulous documentation. The index is clear, and the manual helps you along with diagrams and examples. *Plan* has no tutorial disk. Instead in the first two chapters of the manual, it gives you a printed tutorial that walks you through a variety of spreadsheet tasks.

Plan lets you import files from and export them to *1-2-3*, Releases 1A and 2.0, delimited ASCII, and other *PFS* products. This feature isn't as nice as it could be. *Plan* will interface completely with other products in the *PFS:Professional* series. It will also transport graphs to *Harvard Graphics*. But *Plan* will not convert your *1-2-3* macros, graph settings, tables, databases, and other *1-2-3*–specific functions. It just gives you labels, numbers, and most of the formulas.

Despite its superior graphics, *PFS:Professional Plan* shouldn't cause many worries at Lotus. *Plan* may be just the thing for first-time spreadsheet users. It lives up to Software Publishing Corp.'s reputation for producing user-friendly programs. And, because of its compatibility with other products in the *PFS:Professional* series, it will be attractive to offices that stock their software shelves with the *PFS* library.

Otherwise, there's not much here to threaten *1-2-3*. The row/column designations aren't often seen in other spreadsheets, and probably with good reason: they're clumsy and awkward. *Plan* offers no support for expanded memory, another irritation to power users. *Plan* is slower than *1-2-3*. Its cursor movement is more awkward, and many of its functions just aren't as logical. Lotus lovers won't find much reason to switch.—**Mike Falkner**

Planning Assistant

Planning Assistant, Version 2.0, is IBM Corp.'s $195 private-label version of Software Publishing's old *PFS:Plan*, which was supplanted by the more comprehensive *PFS:Professional Plan* reviewed here. But Big Blue's choice was not the best. Although the *PFS* series in general is not at all bad for beginning users in several product areas, this spreadsheet is so different from the usual approach and so underpowered that it's a poor choice even for the beginner.

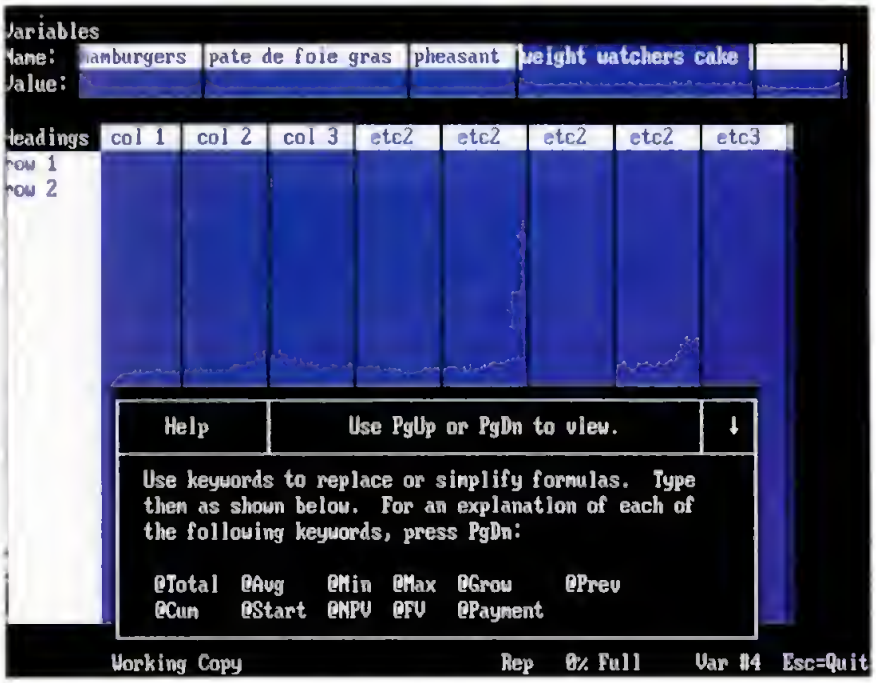
FACT FILE

Planning Assistant, **Version 2.0**
IBM Corp.
Contact your local dealer
Dealer Locator Service:
(800) 447-4700
List Price: $195
Requires: 256K RAM, one floppy disk drive, DOS 2.1 or later.
In Short: An underpowered spreadsheet that doesn't conform to traditional standards
IBM's private-label version of the old *PFS:Plan*. Copy protected.

CIRCLE 003 ON READER SERVICE CARD

Planning Assistant has an unusual interface among spreadsheet products. Cells are not labeled A1, C12, and so forth. Instead, you identify them via on-screen prompts indicating row and column position (for example, R1 C3), the same irritating two-character convention that appears in *Multiplan* and *PFS:Professional Plan*. Specifying formula locations in the spreadsheet is done entirely with headings for the rows and columns. The headings are not counted in the numbers you use; they are a separate entity and are entered into their own heading area.

Several attractive utilities are built in to the heading facility, such as using the F2 key for quick entry of headings. It sequences numbers or dates while retaining format, so 1 will be followed by 2,3,4 . . . , Jan will be followed by Feb, Mar, and so forth, or if you're using numerics, 8601 will be followed by 8602, 8603, 8604. (The same key is used to duplicate cells elsewhere.) If you need to group rows, you can do it by indentation in the headings area, much as you would on an accounting sheet. On the columns side, you can stack things vertically to do grouping. The program automatically keeps you indented in the row labels if you are within a group; hitting Enter moves you to the next line at the same level of indentation (along the left side of the spreadsheet). To return to the



Planning Assistant's pop-up help window provides a quick reference to keystrokes. Further help is available by selecting topics. Note the row and column headings, which were created in the headings area, and the variable area at the top of the screen.

higher levels, you move back to the outside with the cursor keys.

Like the headings, formulas are entered in their own dedicated area, outside the headings area. Again, it can be useful to have them grouped together this way, but it's very difficult to see much of the spreadsheet when they are displayed.

Interesting as this approach is, it can be awkward next to absolute cell referencing. Sums can be very lengthy using this notation if you're used to the *1-2-3* style; you have to learn to use the keywords FOR and EXCEPT in your formulas to include and exclude elements. To get at a specific cell, you have to say phrases such as SALES IN EASTERN, which can get quite wordy. The list of available functions is rather limited, but at-sign functions such as @SUM and @AVG, as well as several other familiar Lotus standards, are present.

LIMITED HELP Help is not context sensitive and is rather limited. It is implemented with an attractive window interface; there's the usual little arrow to show you whether you can scroll the window up or down for more information.

Don't look for graphics or database functions here; you won't find them. You didn't in the old *PFS:Plan* either. Just as *PFS:Graph* was a part of that series, so IBM's *Graphing Assistant* is part of this one. If it's graphs you want, you must buy a second package. You can integrate *Planning Assistant* with the rest of the *Assistant* series, which can exchange files quite well, and whenever you buy one of the series, you receive the menu system, which serves as a higher-level interface. (You can bypass it with direct program calls, thank goodness.) The menus are very useful if you wish to set up applications environments for your clerical staff.

If you need to be prodded into being structured, *Planning Assistant* will certainly contribute by keeping variables in a dedicated area for you. Few people follow good spreadsheet style, which is in many ways good programming style: declaring your variables and assumptions is a particularly good way to do that. Once you put your variables in, you reference them by name as you do with other values. [For hints on good spreadsheet style, check out *The Elements of Spreadsheet Style* by John M. Nevison (Brady Books, New York, 1987). *PC Magazine* also publishes excellent tips every issue in its Spreadsheet Clinic.]

In addition, *Planning Assistant* has a goal-seeking capability called Target. It has some limitations, such as not allowing you to point to calculated fields, but it works well, and the manual contains a discussion of how to accomplish Internal Rate of Return (IRR) computations using the built-in @NPV (Net Present Value, one of three financial functions) and Target.

It's truly unfortunate that Import and Export functions are not significant in IBM's thinking. This is, of course, nothing new. But if you could at least move models into more-capable products, the lack of power in *Planning Assistant* would not seem so constricting. In general, there are many superior alternatives, a number of which are reviewed here.

—Merv Adrian

PlanPerfect

This past June, WordPerfect Corp. changed the name of its $395 spreadsheet program, once known as *MathPlan*, to *PlanPerfect*.

PlanPerfect is built around the same function keys as *WordPerfect*: Shift-F10 reads a spreadsheet into *PlanPerfect*'s memory, and F10 saves it back to disk. Using the function keys saves keystrokes over traditional spreadsheets that follow the convention of using the Slash key to go to Menu mode, File, Save, Return, and Replace. But the difficulty with function keys is that occasional users have trouble remembering which key does what.

HEARTY HERITAGE *PlanPerfect* is an offshoot of WordPerfect Corp.'s successful word processing program. One of the advantages of this ancestry is that *PlanPerfect* can use *WordPerfect* printer drivers, so that if you have *WordPerfect*, you need not load *PlanPerfect*'s drivers.

It is easy to convert *PlanPerfect*'s ranges to columns in *WordPerfect* files: hit Ctrl-F5 for Convert. This brings up a submenu. Choose 3 from the menu to select export format, then I to choose *WordPerfect* format. Hit Ctrl-F5 for Convert again, then 2 from the submenu to export the file.

Funk's new 1-2-3 Performance Software

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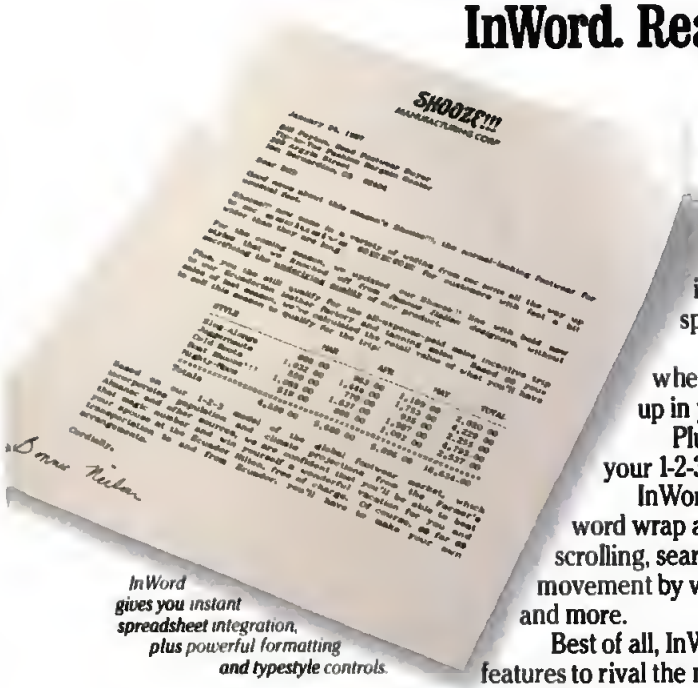

InWord gives you instant spreadsheet integration, plus powerful formatting and typestyle controls.

Now this is what you call teamwork. 1-2-3 handles your numbers while InWord™ tackles your text.

InWord is the full-fledged, full-function word processor that runs right inside 1-2-3. So you can jump back and forth between your 1-2-3 worksheet and your InWord document instantly. Move some text into your spreadsheet. Move some spreadsheet into your text.

And create "live links" directly to data in your spreadsheet. So when you make a change on your spreadsheet, it automatically shows up in your document.

Plus, InWord zips right through mailmerge operations, straight from your 1-2-3 database. It's as easy as highlighting a range.

InWord keeps you moving at top speed, too. With features like automatic word wrap and paragraph reform, horizontal scrolling, search and replace, cut and paste, cursor movement by word, sentence or paragraph—and more.

Best of all, InWord has formatting and printing features to rival the most expensive stand-alone word processors.

You can format your documents with headers, footers, page numbers, tab stops, indents, hanging indents, as well as left, right, center and full justification.

Plus, you can print with bold, underlined and italic text, and mix typefonts and pitch to your heart's content. And since InWord takes full advantage of all your printer's features, you'll be able to create professional printouts of both your text and spreadsheets, whether you have a 9-pin dot-matrix, or a high performance printer like the HP LaserJet.

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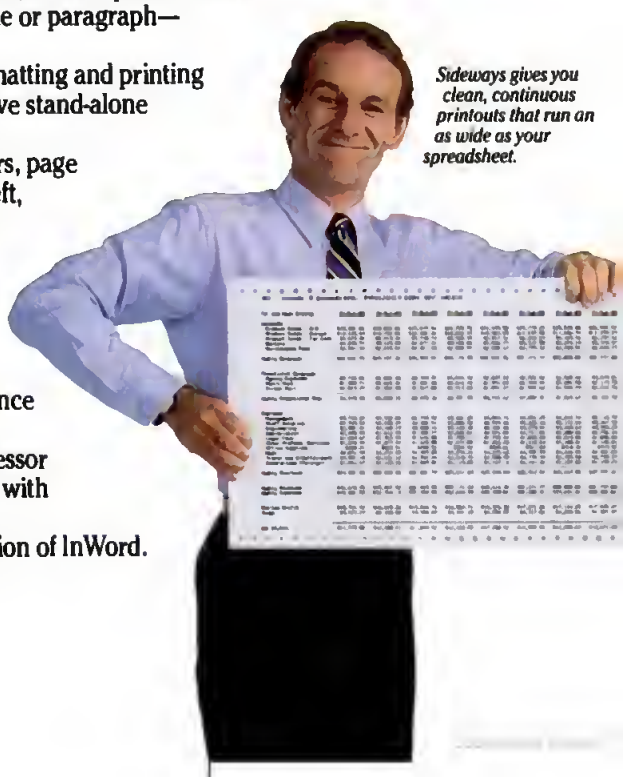
Or go for the power, simplicity and full 1-2-3 integration of InWord. It's just $99.95. *(Requires 1-2-3 release 2)*



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With Noteworthy, neither you nor others who use your spreadsheets need ever forget the true meaning of a cell

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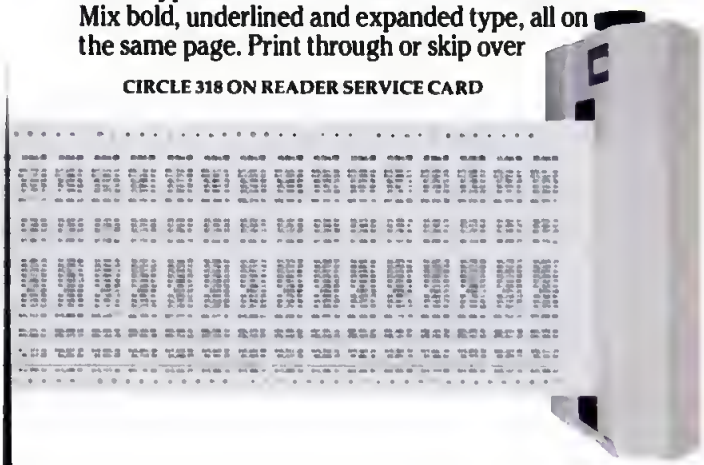

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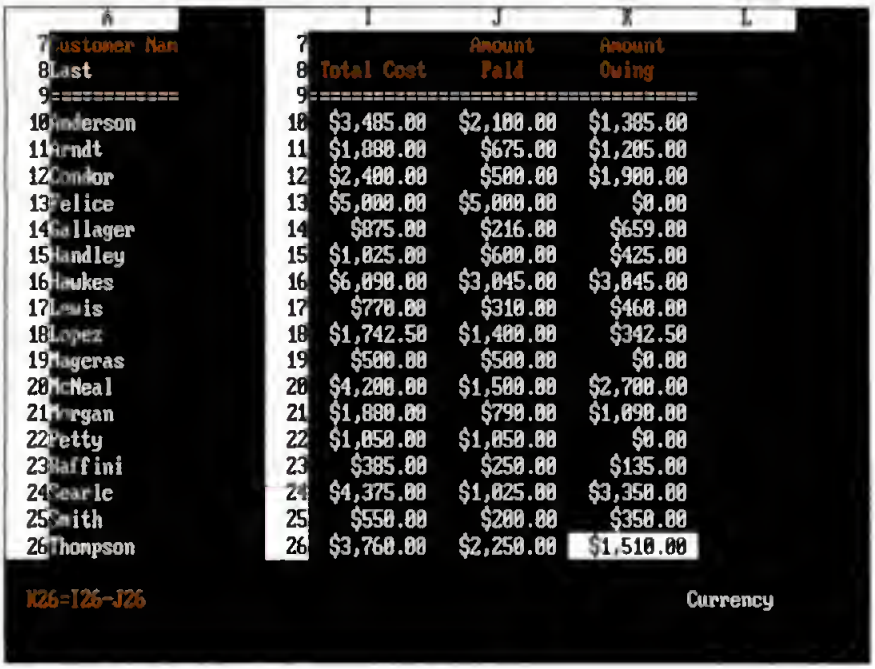

PlanPerfect *has split-window capability. Each window can be scrolled and formatted independently, and there can be different spreadsheets in each of the windows.*

In *WordPerfect* format, each spreadsheet row becomes a line of text. Margins and tab stops are set up to make it look nice.

PlanPerfect automatically spills your spreadsheet out to a work file when it grows too big for memory, just as a word processor spools your document to disk when it outgrows memory. *PlanPerfect* supports expanded memory, but if you don't have it, the work file is a nifty feature that allows your spreadsheet to grow. It will slow down your spreadsheet, but you'll never get a "memory full" message. Instead, what you get is "disk full." Thus, your spreadsheet is not limited to RAM size but can expand to fit the capacity of the disk.

Also in keeping with its word processor heritage, *PlanPerfect* has a text-editing window that puts standard spreadsheet windows to shame.

You can use *PlanPerfect* to generate customized letters from a database. Write the letter in *PlanPerfect* or *WordPerfect* so that it gets the name and address from two cells, then write a macro to select records from *PlanPerfect*'s database, copy data from each record into those cells, and print. This macro implements the mail-merge function, which is explained in minute detail in *PlanPerfect*'s notes.

LINK CAPABILITIES *PlanPerfect* also lets you link spreadsheets. A link is a disk filename that identifies the worksheet containing the data you want to copy, a cell or range in the source worksheet, and a cell or range in the destination spreadsheet. The source data may be copied, added, subtracted, multiplied, or divided into the destination sheet. This is a convenient feature, but more's the pity that *PlanPerfect* won't let you also link references in a formula. If you change the source worksheet, the destination worksheet is automatically updated the next time you open it.

There are other nifty features in *PlanPerfect*. A formula containing only a "+" sums nonblank cells located immediately above it until it finds the first blank cell. It displays the total in the cell with the +. Unfortunately, you have to update horizontal sum ranges manually when you insert a column.

PlanPerfect lets you attach custom help messages to individual cells. Your messages are displayed when the user asks for help while the cursor is on a cell with a custom message. *PlanPerfect*'s database is above average: it lets you search columns by name. The tutorial does a nice job but, unfortunately, omits databases and macros. The program flags a number that is too big to fit in a column. *PlanPerfect*'s spreadsheet has the feel of a programming language. If you do not find what you need in *PlanPerfect*'s 85 built-in functions, you can develop your own and refer to them when writing formulas. It also supplies real programming constructs, like loops and case statements.

PlanPerfect can import *1-2-3* spreadsheets, but keyboard macros are not converted, and you may have to fix some of the formulas. I fail to see why they did not convert all the formulas: there seems to be nothing *1-2-3* can do that *PlanPerfect* can't.

MATHPLAN MEMORIES When WordPerfect Corp. renamed its spreadsheet, it changed the packaging but very little else. The documentation and many of the help screens still refer to the program as *MathPlan*.

PlanPerfect's quick-reference guide could be better. It is arranged alphabetically, and it is hard to find functions when you do not know what they are called.

The graphics package is not terribly well integrated. When you try to plot a range it does not like, it tells you "Illegal Block." The manual says that means you have misspelled a cell number, but the pro-

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***PlanPerfect*, Version 3.0**
WordPerfect Corp.
288 W. Center St.
Orem, UT 84057
(801) 225-5000, Information
(800) 321-5906, Support
List Price: $395
Requires: 256K RAM (or 320K RAM for bit-mapped graphics), two disk drives, DOS 2.0 or later.
In Short: A powerful spreadsheet that can handle massive spreadsheets without expanded memory. Not copy protected.

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gram blocks you even when the cell number is correct. This and other error messages could be more context dependent.

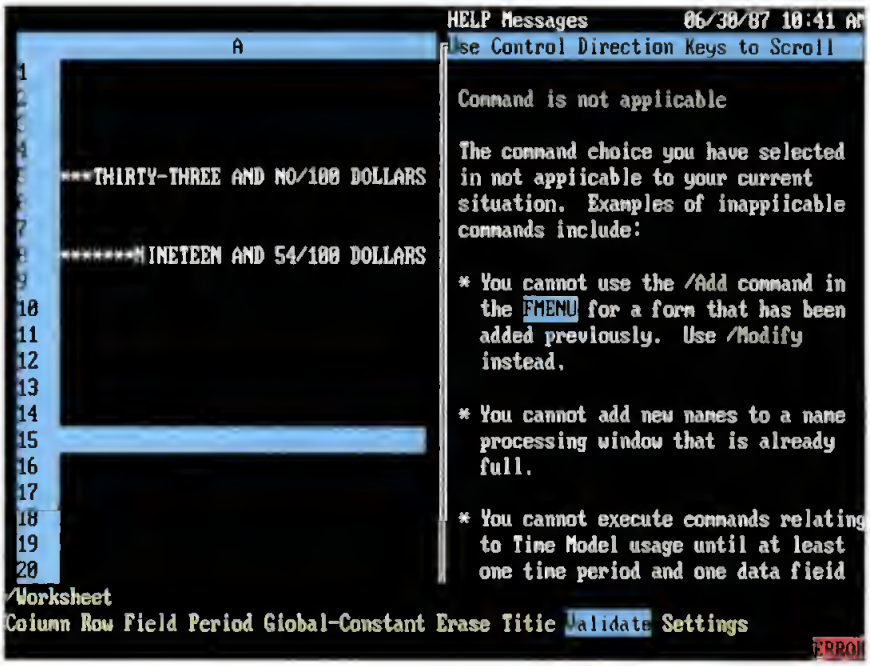
All in all, *PlanPerfect* is powerful and professionally implemented, even if its philosophy was guided by word processing considerations. It is an excellent tool for word processor users, especially if they use *WordPerfect*.—**William A. Taylor**

Silk

Silk, from Daybreak Technologies, is one of the most promising of the post-*1-2-3* spreadsheets. Unlike the champ's traditional competitors, such as *SuperCalc* and *Multiplan*, which were introduced before *1-2-3*, *Silk* was designed for a world that had already embraced the Lotus standard. It carefully maintains the features that have made *1-2-3* a success while adding a host of new ones.

At the same time, *Silk* is not a superset of *1-2-3*. It's different enough to avoid a "look-and-feel" suit, yet close enough to be easy for Lotus users to learn. Whether it's the giant killer its ads claim it to be remains to be seen, but it's certainly one of the toughest competitors *1-2-3* has to face. Moreover, at its list price of $298, it sells for considerably less than *1-2-3*. Its only real drawbacks are its gluttony for memory and slightly disappointing recalc times.

Silk has drawn heavily on *1-2-3*'s style and appearance. Its two-line menus and command structure are comfortably familiar. Simple routines like /File Retrieve or /Worksheet Erase Yes are identical, but complex commands are different. *Silk* also uses *1-2-3*'s excellent cursor control commands, and its macro language is close to Release 2.01's. *Silk*'s built-in functions are nearly identical to *1-2-3*'s, except for database and time functions: *Silk* simply left them out.



Silk *uses an interactive help window that tells you why the command just selected will not work. In the part of the spreadsheet visible in column A, numbers are displayed as words in check-writing format.*

One interesting departure from *1-2-3* convention is the way that *Silk* interprets input data. You must always precede a label with a label prefix, since *Silk* won't automatically treat alpha strings as labels. On the other hand, function names don't have to start with a special character like the at-sign (@), and you don't have to start a formula like A1+B1 with a plus sign. *Silk* recognizes these entries as formulas, not labels.

Aside from these differences from *1-2-3*, *Silk* is packed with improvements. The flashiest is *Silk*'s interactive help. When you turn it on, the right half of the screen turns into a constant tutor. Every time you make a menu choice, the tutor updates immediately to explain your new choices. Help screens in other programs interrupt your work with their explanations, but *Silk*'s are by your side while you work. Explanations are fully detailed, and you can scroll the help text if necessary. *Silk* is so confident you'll use its help screens that it hasn't bothered to include full descriptions of functions in the manual. They're all in the help screens.

Silk uses function keys more cleverly than does *1-2-3*. All ten have control-shifted as well as unshifted functions. Ctrl-F5, for example, is a quick way to blank the current cell. If you're tracking circular errors, F4 takes you to the next offending cell. F8 inserts a single cell vertically in your worksheet, and Ctrl-F8 deletes one—a wonderful tool for editing macro script. F10 sends the cursor to the most recently edited cell and restores its previous contents. Ctrl-F9 executes whatever macro script the cursor is on—a quick way to test a macro without running it from the beginning. And so on.

EASIER EDITING *Silk* also makes editing long formulas easier. You can use the whole bottom half of the screen if you need it and view nearly 800 characters at a time. A single cell can hold as many as 4,000 characters, though I can't imagine formulas that long. What could push you past the 1,000 character mark, though, is formula annotation. If you put the number sign (#)

EDITOR'S CHOICE

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***Silk*, Version 1.0**
Daybreak Technologies Inc.
2271 205th St
Torrance, CA 90501
(213) 212-3030
List Price: $298
Requires: 512K RAM, two disk drives, DOS 2.0 or later.
In Short: A powerful spreadsheet that offers many features not found in Lotus's *1-2-3*. Not copy protected.

CIRCLE 687 ON READER SERVICE CARD

Performance Tests: Spreadsheet Programs

Even though competitors have had 2 years to match and exceed Release 2 of *1-2-3*, the program is still faster than all but two of the spreadsheets on flat-out calculation speed. *Silk*, our Editor's Choice among traditional spreadsheets, is below average on calc speed but makes up for it with richness of features. Note that the two best-known 3-D spreadsheets, *microCUBE* and *Boeing Calc*, are markedly slower than the rest of the field when used as traditional spreadsheets—which may help explain, in part, their still-modest market acceptance.

PC/Foccalc, which runs in the Focus environment, is the fastest product tested in terms of calculation speed. Several programs—including *Boeing Calc*, *TM/1*, *Silk*, *VP-Planner*, and *Multiplan*—offer faster disk load and save times, which may be preferable for doing many small spreadsheets rather than a single large one. IBM's *Planning Assistant* could not be tested in this review because it is unable to calculate square roots, one of the elements of the spreadsheet on which the programs were tested.

For the spreadsheet performance tests, we filled the 2,080 cells between A1 and Z80 with labels and with formulas that do four-function math and square roots. The tests were conducted on an 8-MHz AT with 640K bytes of RAM and a 30-megabyte hard disk drive.

The **Calc Speed** test measures how long it takes the program to recalculate the test spreadsheet.

The **Save to Disk** test measures how long it takes the program to write the spreadsheet to disk.

The **Load from Disk** test measures how long it takes the program to read the spreadsheet from disk.

The **Worksheet Memory** test reports how much RAM is available for spreadsheet models when the spreadsheet is empty.

The **Memory Used** test reports how much RAM is available after the test spreadsheet has been loaded.

The **Disk Space** test measures how large a file the program writes when it saves the spreadsheet to disk.

Performance Times
(Times given in seconds)

	Calc Speed	Save to Disk	Load from Disk	Worksheet Memory (K bytes)	Memory Used (K bytes)	Disk Space (K bytes)
3-D SPREADSHEETS						
microCUBE	358.0	49.6	43.6	N/A*	N/A*	117.0
Boeing Calc	317.0	17.0	8.0	N/A†	N/A†	122.9
TM/1	150.0	13.5	12.5	405.0	313.0	7.1
TRADITIONAL SPREADSHEETS						
The Twin Classic	182.0	34.0	30.0	363.0	89.0	80.9
SuperCalc4	124.0	23.0	22.0	260.0	86.0	90.9
Silk	124.0	13.0	14.9	250.9	90.5	85.6
PFS:Professional Plan	112.3	9.3	10.5	N/A*	N/A*	45.1
VP-Planner	104.7	19.8	15.7	402.0	72.0	71.0
Words & Figures	102.0	32.0	30.0	367.0	93.0	79.7
PlanPerfect	91.0	26.0	34.0	401.4	99.3	86.2
1-2-3, Release 2.01	70.0	32.0	29.5	424.0	73.7	79.9
Multiplan	66.0	20.0	17.7	N/A*	N/A*	38.6
PC/Foccalc	12.8	37.1	35.0	201.6	41.8	92.3

N/A*—Not applicable: program does not report the amount of RAM used by the empty worksheet and reports Memory Used as a percentage of the total RAM available. The test spreadsheet used 28.5 percent of *microCUBE*'s work space, 18 percent of *PFS: Professional Plan*'s work space, and 8 percent of *Multiplan*'s work space.
N/A†—Not applicable: *Boeing Calc* uses virtual storage on disk.

at the end of a formula, *Silk* treats anything that follows it as comments. This device lets you write detailed explanations of formula logic.

Even formulas without comments are likely to be clearer if you use *Silk*'s global constants. If you define TAXRATE as .28, you can use the word instead of the number in any formula. You can define 240 such constants.

Another way to make sense out of formulas is global search and replace. You can search for text or number strings in labels or formulas. This way you can quickly find all references to cell B52, for example, and change them to F16 if you want. This is such a useful feature; you'll wonder how you lived without it.

Silk also lets you rearrange your worksheet after it's built. Change the column order to C,A,D,B instead of A,B,C,D if you like. Do the same thing with the rows. If you like the new arrangement, *Silk* can make it permanent. All formulas neatly update.

If you work with foreign currencies, *Silk* makes your life simpler. You can define a primary currency and two secondary currencies, along with their symbols and exchange rates. Thus, if your primary currency is the dollar and you define the yen as 150 to the dollar, the number 2 in a yen-defined cell will appear as 300. Pretty

slick—not to mention useful, too.

Silk's graphics are more powerful than *1-2-3*'s. *Silk* offers more types of graphs and allows you to make more changes on the screen. Even so, quality is still not up to the standard of dedicated graphics packages, and you must first dump a graph to disk before you can print it.

You can translate worksheets pretty effectively between *Silk* and either version of *1-2-3*.

Silk has put a lot of work into a feature that lets you build time-series models. Much as you do with *Javelin* or *PFS:Professional Plan*, you establish time periods across the top row of the model and figures for Sales, Expenses, Profits, and so forth in the rows beneath. You can then define formulas such as Profits = Sales - Expenses, so that every cell in the Profits row will show that period's profits. Since a single formula does the calculations for every period, models of this kind are quicker to build and take less memory.

Time-series models can be templates for data entry. You can define only certain cells for input and write prompts that tell unsophisticated users what sort of data you expect. You can even set limits on the kind of data a cell will accept—alpha or numeric, greater than, less than, and so forth. This keeps your models from going too spectacularly wrong.

RECOVERY SYSTEM Another great feature is *Silk*'s model recovery system. If you use a hard disk, the program can log your keystrokes to a file while you build a spreadsheet. If you lose your work, you can read the log file, and *Silk* will rebuild the spreadsheet, step by step, at macro execution speed. It takes a little time, but it's quicker than doing it yourself. If you like, you can even run a little *Silk* program to turn the log file into a macro, or vice versa.

Another nice feature is a numbers-to-words cell format. This makes the number 666 display as six hundred sixty-six, which makes it easy to write checks. *Silk* also has two levels of security. Anyone can save models with a password that only the security manager can decode. *Silk* also has a very handy date-entry technique. Since @ isn't needed for functions, you enter dates in the convenient form; @12/25/87. This form stores the date as a serial number for date arithmetic and also gives you a choice of 14 different date display formats.

Finally, you can translate worksheets pretty effectively between *Silk* and either version of *1-2-3*. Translated macros will run, but since many command sequences are different, you'll have to adjust them by hand. Most of the built-in functions will translate perfectly.

Nevertheless, for *Silk*'s features, you pay a high price in memory. It leaves you approximately 160K bytes less of RAM for worksheets than *1-2-3* does. On a small system, that could make a big difference. Also, if I write huge spreadsheets, I would want to switch from *1-2-3* to a program that calculates faster, not slower.

I miss the *1-2-3* database, and I also like a complete reference manual; it's hard to put good diagrams into help screens. Finally, the program doesn't support very many printers, though Version 1.01, which is supposed to be on its way, should support more.

Still, depending on your needs, these may be minor complaints. At $298, *Silk* is a crackerjack program at a reasonable price.—**Jared Taylor**

SuperCalc4

SuperCalc is a survivor. It is one of those rare spreadsheets that were introduced *before 1-2-3* and are still around in a world now dominated by Lotus. Made by Computer Associates International, *SuperCalc* has matured over the years into a powerful, well-designed program that can hold its own in a point-by-point comparison with any competitor, and it costs the same as *1-2-3*, $495.

The *SuperCalc4* screen has the usual spreadsheet look, with the added touch that the borders use reverse video to show you the location of the cursor. The screen has a slightly cluttered look, though, because of the constant display of what F1, F2, and Ctrl-Break do—nice for real beginners but pointless for anyone else. On the other hand, once you've developed your model you can clean the screen up dramatically by turning off the entire row-number/column-letter matrix. This makes for a very professional look.

SuperCalc has used Slash-key commands since before *1-2-3* existed, so it's no surprise that its command sequence is different. For example, commands to print to a file or printer begin with /O for Output. Likewise, in order to run advanced import-export and macro commands, you bring up a secondary command menu by hitting the Slash key twice. These distinctive sequences are well planned and make sense, but they may seem odd to hardened *1-2-3* users.

One *SuperCalc4* feature that everyone will love, though, is its ability to parse data as you enter it into a cell. Functions don't have to be preceded with any special character like the at-sign (@), nor do you have to indicate labels with a label prefix. For example, *SuperCalc4* knows that if you enter sqrt(2), you want a display of 1.414214. It also knows that if you enter sqrt(two), you have just entered a rather odd label and not a formula. Since the program almost never confuses labels and formulas, you don't have to worry about how you write them.

One limitation this does impose on you,

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SuperCalc4
Computer Associates International Inc.
2195 Fortune Dr.
San Jose, CA 95131
(800) 533-2070
(408) 432-1727
List Price: $495
Requires: 256K RAM, two disk drives, DOS 2.0 or later.
In Short: A powerful spreadsheet with better graphics than Lotus's *1-2-3*, but less sophisticated string capacity. Not copy protected.
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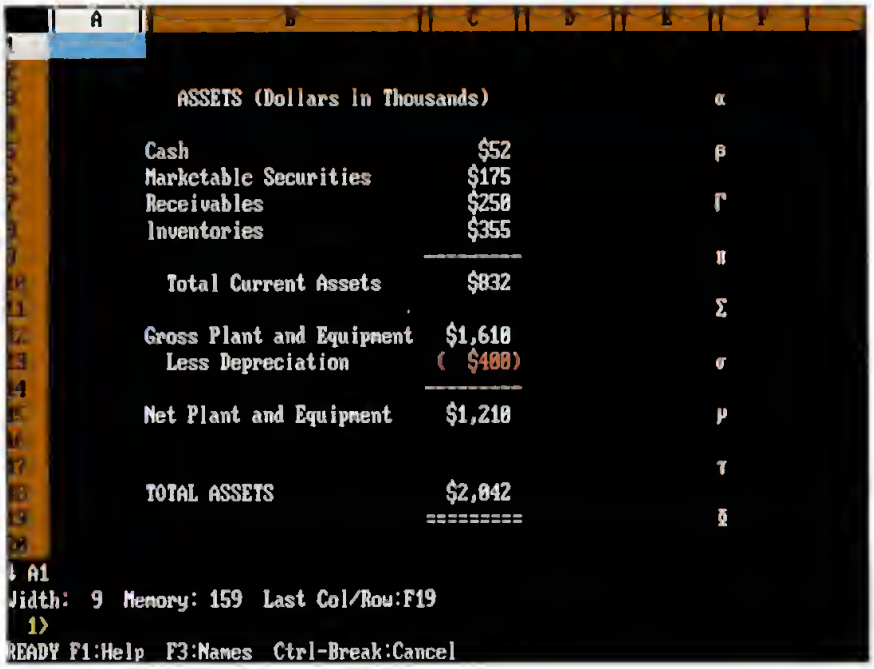

SuperCalc4 *has a user-defined format for numbers. All values have a leading dollar sign and floating commas, and are divided by 1,000. Negatives are shown in parentheses. To the right are high-bit ASCII characters entered with the Alt–Number Pad combination. The last line clutters the screen, but the column/row borders can be turned off.*

though, is that you shouldn't use function names as range names. If you call a cell SQRT, the program warns you that you are redefining a function name and, sure enough, if you try to use the function later on, it won't work.

SuperCalc4 gives you some handy cursor controls, as well as some excellent screen-building commands. For example, Ctrl-Home takes you to the top-left-hand corner of the current screen, and Ctrl-End takes you to the bottom right. There are also commands that take you to the edges of the active area. For rapid data entry, you can combine arrow-key cursor controls with the Return key. This way, you can use the NumLocked number pad with Return to enter a series of numbers very quickly down a column or across a row.

One of the handiest screen-building commands is Move Column or Row. If you move row 4 to row 23, say, row 5 will move up to take its place and row 23 will move down to let it in. Formulas will adjust. This is much handier than the Insert-Copy-Delete routine that *1-2-3* would put you through. Likewise, you can insert ranges anywhere in the spreadsheet, without opening up whole columns and rows. Just drop a chunk down anywhere you like, and the data will move down or to the right just enough to let it in; you don't have to insert or delete anything.

CONVENIENT OPTIONS The copy command, which you can use just like *1-2-3*'s if you like, has other convenient options. For instance, you can copy formulas so that their references aren't adjusted, or so that only values are copied. Even more interesting, you can use the copy command to do four-function math. If the destination range already has values in it, you can multiply them, say, by the values in the source range.

Another command lets you indicate a cell, edit its formula, and then enter the results into another cell. This way, if you need to vary a formula slightly from cell to cell, you can do the editing and copying in a single step.

Another convenience is *SuperCalc4*'s eight user-defined cell-display formats. You could define a financial statement format so that all numbers are preceded by the $, with commas embedded, negatives in parentheses, zeros to appear as blanks, and with all values divided by 1,000. You can mix and match different format elements to come up with whatever suits you.

You can print a *SuperCalc4* worksheet more conveniently than you can using *1-2-3*. Printing parameters are easier to set because you get a full display of current settings while you change them. Also, you can specify ALL as the print range if you want to print the whole model. You can print multiple copies and include up to four headers and footers instead of *1-2-3*'s one each. If you like, you can print the column-letter/row-number matrix along with your model or give it custom-designed borders with characters that you choose. *SuperCalc4* comes with a built-in sideways print utility Computer Associates began incorporating into *SuperCalc3* under a license from Funk Software, which sells *Sideways* as a program for the PC. If you have a graphics printer, you can flip the printout 90 degrees and print models as wide as you like. Sideways printing is slower than conventional printing but quite handy when you need it.

SuperCalc4 gives you good graphing flexibility, with seven graph types instead of *1-2-3*'s five: *SuperCalc4* adds a high-low chart and an area chart. You have more control over a chart's appearance on the screen, and the charts look better than *1-2-3*'s. Moreover, you can print from within the program: you don't have to print to disk first and then run another program.

SuperCalc4's macro language has many advantages, while it falls short in a few areas. Perhaps its greatest advantage is that macros can be run from files on disk. This means that macro script needn't take up spreadsheet space, and you can run the same macro from any number of different spreadsheets. Macros can use the \y naming convention, where y is a letter of the alphabet. This way, if you hit Alt-Y, *SuperCalc4* looks first for macro script within the spreadsheet. If it doesn't find the range name \y, it looks for a file named Y.QXT on disk and runs the macro script in that file. If you like more-descriptive names for your routines, you can use the Alt-F5 macro-invoking command followed by the macro's name. Another very handy feature for beginners is the macro Learn mode; turn it on and the program will re-

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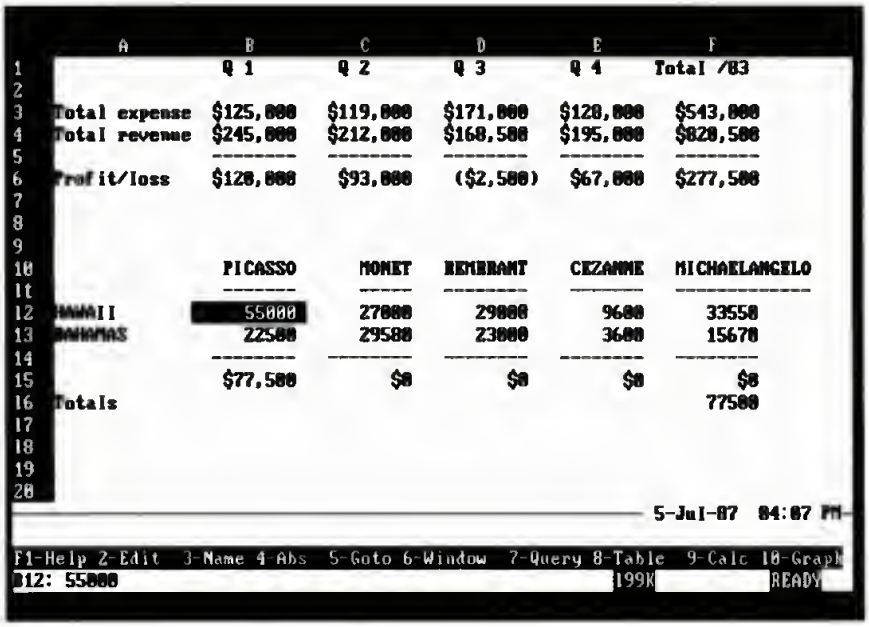
cord your keystrokes as a macro script.

The macro language cannot handle string functions the way *1-2-3* does, nor can you use it to write and read ASCII files. It has no equivalent of the @cell-pointer function, though some of its power can be duplicated by using *SuperCalc4*'s logical functions like ISSTR or ISNUM, or indexing functions like CURROW and CURCOL.

NUTS AND BOLTS At the nuts-and-bolts level, *SuperCalc4* has included convenient ways to adapt the program to your hardware. If you need as much worksheet space as possible, you can set *SuperCalc4* so that it loads fewer program modules into memory. This means it will go to disk more often, but by using this option I got 174K more RAM for models. If you build very large spreadsheets but would like to carry them around on floppies, you can save a model, in pieces, on more than one disk. One increasingly common system-level feature that *SuperCalc4* did not include is a temporary exit to DOS. That's a convenience I'd hate to do without.

The *SuperCalc4* documentation is adequate but certainly not brilliant. I wish it had evolved as steadily and as promisingly as did the program itself. Still, on balance, *SuperCalc4* is a great spreadsheet with many fiercely loyal users.—**Jared Taylor**



Although similar to 1-2-3, The Twin Classic, *from Mosaic Software, reverses the screen order so that the spreadsheet area is at the top and the menu lines and status area are at the bottom. Going one better than* 1-2-3, *the status line shows available memory, and the prompt line shows the function-key definitions.*

The Twin Classic

The Twin Classic, which lists at $99, was one of the first spreadsheets based on the idea that people should be able to buy *1-2-3* functionality without paying *1-2-3*'s price.

It looks like more of a fraternal than an identical twin to *1-2-3* but it sure makes a *1-2-3* user feel at home. It comes with a batch file that quickly loads its three program disks onto your system, and it isn't copy protected. *The Twin Classic* is part of Mosaic Software's *Integrated 7* series that also includes a database, word processing, and communications packages.

You can change printers, plotters, and screen types at any time from a menu command within the spreadsheet. However, Mosaic gives you that ability by limiting the number of printers and screens that are available to you. Printer choices include Epson, Okidata, the HP Laserjet, and some generic types that should work with most printers. *The Twin* supports a monochrome adapter, a Hercules card, and a Color/Graphics Adapter (CGA). It also supports your Enhanced Graphics Adapter (EGA), but only in CGA mode.

LOOK ALIKE *The Twin*'s screen looks like *1-2-3*'s, but some items have been moved. The spreadsheet area consists of eight columns, labeled A through H, highlighted at the top, and rows 1 through 20 are highlighted along the side. A dotted line displaying date and time separates the spreadsheet from the command area. There is the familiar two-line menu that you access by hitting the Slash key (/). The status line positioned at the bottom of the screen displays the current cell, its contents, available memory, the status box, and a few other items.

The basic operation of *The Twin*'s spreadsheet is identical to *1-2-3*'s. The cursor keys move you one cell in any direction, while the PgUp, PgDn, Ctrl–Left Arrow, and Ctrl–Right Arrow keys move you one screen at a time. *The Twin* displays the information you enter in the status area and determines whether you are typing numbers or labels by checking the first character. *The Twin*'s at-sign (@) functions are the same as those in *1-2-3*, Release 1A, but you get three additional logical functions (@AND, @OR, and @NOT) and two financial functions (@RATE and @MIRR).

The Worksheet command in the menu

PC MAGAZINE FACT FILE

The Twin Classic
Mosaic Software Inc.
1972 Massachusetts Ave.
Cambridge, MA 02140
(800) 422-8946
(617) 491-2434
List Price: $99

Requires: 320K RAM, two disk drives, DOS 2.0 or later. Graphs can be displayed on the screen if a graphics card is present.

In Short: A clone of Lotus's *1-2-3*, Release 1A, but with some good additions. The slow speed will irritate you but, if you know *1-2-3* commands and features, you're ready to go the minute you open the manual. Not copy protected.

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TEMPLATES OF DOOM: AN ADVENTUROUS TOUR THROUGH YOUR SPREADSHEET

Templates of Doom is that rare, rare bird: an instructional program that's actually fun to use. It's an adventure game, written entirely in *1-2-3* macros, that teaches you how to use a spreadsheet. It keeps score while you play, and if you know *1-2-3* inside out, you'll come out a winner.

The game is made up of 16 different spreadsheets, each of which makes you solve an adventure game riddle: What is the hero's weapon? Who is the hero's girlfriend? Who are the villain's accomplices? And so on. By using the right spreadsheet techniques, you can solve the riddle and get the answer. You may have to adjust column widths, sort data, draw graphs, write formulas, set windows, or use other spreadsheet tricks.

If you're stumped, you can choose from four levels of hints. The first level is an obscure clue for baffled experts, while the last level steps beginners right through to the solution. Your final score depends on how long you take to find the answer, but you're penalized if you need to ask for hints.

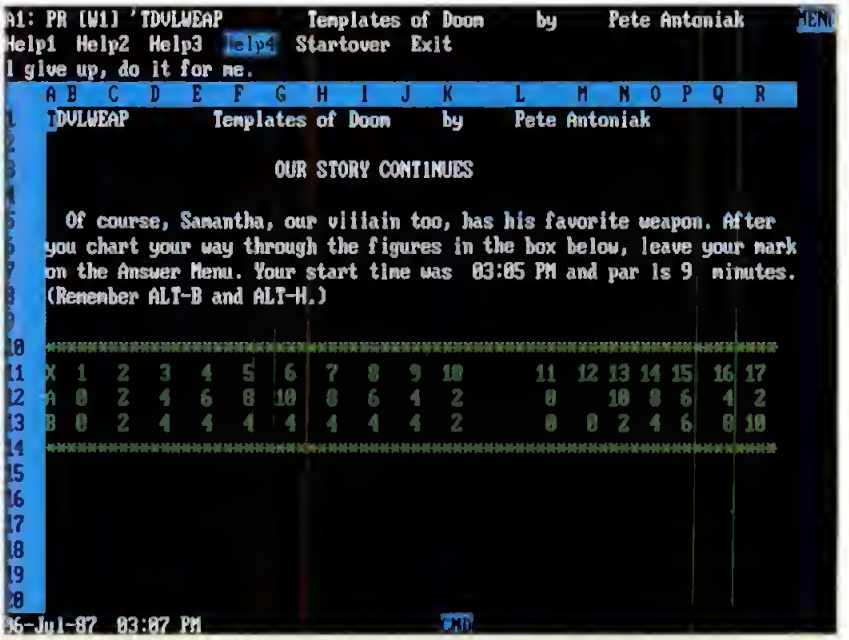
If you don't have a computer at home and have to sneak in your game playing on company time, *Templates of Doom* can masquerade as work. If the boss walks in while you're hunting for the the hero's pet, Alt-B (for boss) puts an innocuous-looking budget projection on the screen.

Templates of Doom is an entertaining challenge even for *1-2-3* experts. Its problems are clever and its solutions ingenious. Also, it's something of a macro language tour de force and will give you plenty of good material if you enjoy deciphering program logic.

This game is probably best for classes in *1-2-3*, where a whole group can enjoy it. If you buy a copy for yourself, you'll have a good time, but you'll soon know all the answers.

The current version of *Templates of Doom* works with all releases of *1-2-3*, and with *The Twin Classic* and *VP-Planner*. The next version will work with *Words & Figures*, too, and a *SuperCalc4* version should be out soon.

—Jared Taylor



Templates of Doom walks you through spreadsheets as adventure games do through the Colossal Cave. The program speaks to you by name, as it did here to Samantha, and describes your progress as you master the spreadsheet commands and functions.

FACT FILE

Templates of Doom
Solar Systems Software
8105 Shelter Creek
San Bruno, CA 94066
(415) 952-2375
List Price: $49.95 (plus $2.50 postage and handling).
Requires: 256K RAM, Lotus's *1-2-3*, or a compatible such as *VP-Planner* or *The Twin Classic*, DOS 2.0 or later.
In Short: A clever adventure game that teaches spreadsheet techniques. Not copy protected.

CIRCLE 678 ON READER SERVICE CARD

contains two additional features. /Worksheet Global Hardware lets you select screen types, printers, ports, and plotters. /Worksheet Global Define Colors lets you control your foreground and background colors for cells, cell protection, and menus. The Copy, Move, and Range commands mirror *1-2-3*'s, and Range lets you give an area of your spreadsheet a name. The Print command is similar, but it also lets you print row and column labels.

Mosaic also cloned *1-2-3*'s limited database capabilities. Database information is stored in cells; each column indicates a field, and each row represents a record. To manipulate the data, you must first create a range name that includes all the records in the database. Next, you create a range that

> *The Twin* is a bargain for the user who isn't in a hurry and needs an inexpensive spreadsheet.

contains the same field names and the criteria to be used for searching and extracting data.

Mosaic's import and export capability is impressive. *The Twin* normally saves a file in its own format, using a .WKT file extension. You can also use File Translate to save your files in a *1-2-3*, Release 1A, format with a file extension of .WKS, or in a .DIF format with a .DIF file extension. File Import will load *The Twin*'s files, *1-2-3* 1A's files, or any files created with text format, numbers, comma-separated values, or .DIF.

GOOD GRAPHICS Mosaic has certainly improved on *1-2-3*'s approach to graphics. *The Twin* allows you to plot up to eight sets of data on line, *x-y*, vertical bar, horizontal bar, 3-D bar, pie, 3-D pie, and pie-bar charts. You create the graphs by entering the row and column references for each set of data points. You can print out a bare-bones graph immediately to your screen, printer, or plotter.

To add legends, titles, and other chart definitions, you select Options: *The Twin* will clear the bottom half of the screen and prompt you with three screens requesting data. Titles and footnotes and their colors are added in the first screen. Axes and scales are defined in the second screen, while legends, colors, patterns, and miscellaneous graphs information are given in the third. You can name your graphs and save more than one with your spreadsheet.

The Twin's macro capabilities are also the same as those in *1-2-3*, Release 1A. Keystrokes in a cell are given a range name and a letter from A to Z. When the letter is typed with the Alt key, the keystrokes are executed. Mosaic also included *1-2-3*'s /X macro commands for branching, jumping, calling subroutines, asking for input, and creating menus. *The Twin* uses the substitute symbols for keys such as Left Arrow ({LEFT}) and Right Arrow ({RIGHT}) as well as some non-*1-2-3* symbols like Ctrl–Right Arrow ({CRIGHT}).

The Twin's documentation is aimed at the new user. It's not likely to win a size-and-weight contest, but the manual does give you the basics. A well-prepared tutorial covers most of *The Twin*'s capabilities. The database and macro sections are a bit skimpy, but the well-organized reference guide is about all that's needed for knowledgeable *1-2-3* users to pick up the program and start using it.

Mosaic did a thorough job of cloning *1-2-3*, Release 1A, and did make some nice improvements, but some of *1-2-3*'s features in Release 2.0, including the way files are accessed and subdirectories interrogated, would make *The Twin* a nicer package.

The Twin is a much slower program than *1-2-3*, taking twice as long to calculate a spreadsheet. EGA screens are not fully supported, and even the graphs done in CGA mode are not impressive. *The Twin* offers no support for expanded memory; its formulas do not return both text and values, and its macro commands are skimpier than those in *1-2-3*'s Release 2.0.

The Twin is a bargain for the user who isn't in a hurry and needs an inexpensive spreadsheet with the capabilities of *1-2-3*.
—Mike Falkner

VP-Planner

Lotus's look-and-feel lawsuit brought a lot of attention to Paperback Software's *VP-Planner*, a $99.95 *1-2-3*, Release 1A, spreadsheet. Notwithstanding Lotus's claim, *VP-Planner* is an excellent package that has more features than *1-2-3*, Release 1A. You can make it multidimensional, and you can access *dBASE* files.

VP-Planner can do anything *1-2-3*, Release 1A, can do, and more. It can read and write to any worksheet composed on any version of *1-2-3* or *Symphony*, and it can translate to a .DIF or .SDF file format. You can change colors from the menu, protect files with passwords, hide columns by setting column widths to 0, and set column widths by range. Menus are on the bottom of the screen, underneath the spreadsheet. In the Ready mode, the time, remaining memory, and function key definitions are displayed.

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***VP-Planner*, Version 1.34**
Paperback Software
2830 Ninth St.
Berkeley, CA 94710
(415) 644-2116
List Price: $99.95
Requires: 256K RAM, one disk drive, DOS 2.*x* or later.
In Short: An excellent, *1-2-3*, Release 1A, clone with multidimensional capabilities. It can also read and write *dBASE* files. Copy protected.

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The macro language is comparable to that of *1-2-3*, Release 1A, but *VP-Planner* has a terrific auto-key feature that records keystrokes to create macros. You can program ten function keys as auto-keys, or record them to cell addresses and assign up to 27 more macros per worksheet. *VP-Planner* can run any *1-2-3*, Release 1A, function, plus a few of its own.

The features that really set *VP-Planner* apart from *1-2-3*, Release 1A, though, are its multidimensional databases and its ability to work with *dBASE* files.

Through the "/Data External dBASE" command you can create *dBASE II* or *III* files. You have the opportunity to copy fields and records from a previously created *dBASE* file; you're able to import the fields you want, edit the records, and have them overwrite the original files. *VP-Planner* will not let you delete records from an external *dBASE* file, but you can append to it or browse through it. Unlike *1-2-3*, *VP-Planner* lets you convert a .WKS file into a *dBASE* .DBF file while in the spreadsheet, without going through an external translation utility.

The multidimensional database is far more complicated than the *dBASE* link. *VP-Planner* recognizes up to five dimensions, but the links require a complicated and extensive setup procedure. It's called a database because essentially you are creating five one-dimensional tables that are linked through a two-dimensional work-

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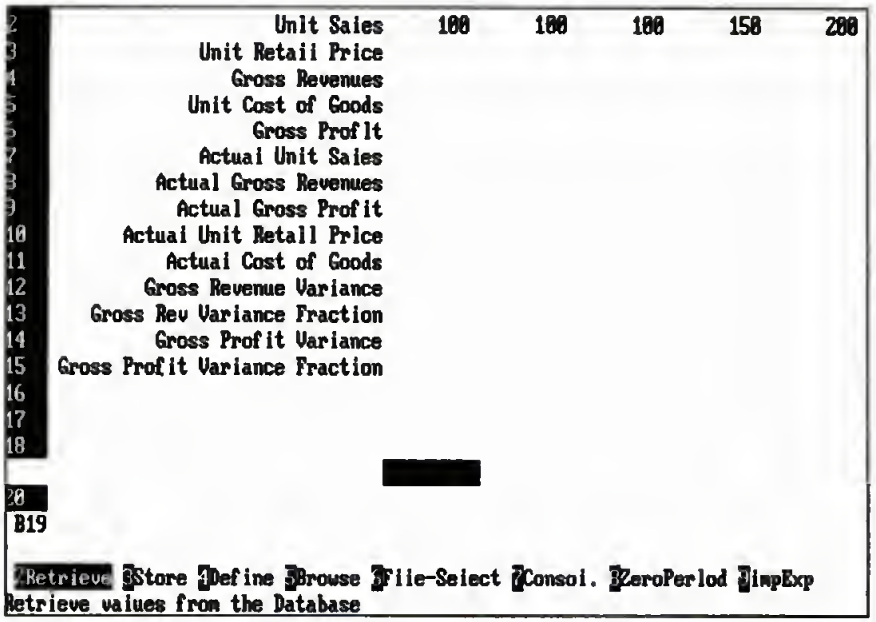

VP-Planner is a 1-2-3, Release 1A, clone with multidimensional capabilities. You can create a database with up to five dimensions, but you use a 2-D spreadsheet such as this one to view a "slice" of your data.

sheet. Because of virtual memory, you can work with a maximum file size of 17 megabytes.

For instance, you can have a multidimensional file that contains the time period (Jan to Dec) as the first dimension, accounts (unit sales, COGS, GP) as the second, products as the third, sales regions as the fourth, and divisions as the fifth. You can then use the browse feature to view a single dimension or, again through a series of complicated steps, create a worksheet window to view two-dimensional slices of the five dimensions. This is a complicated feature that I do not recommend for the fainthearted.

Graphics are on a par with *1-2-3*, Release 1A, with five graph types. But you don't have to leave *VP-Planner* to print a graph. If you have a graphics printer, you can do it from the menus. You can save the graph as a .PIC file if you want to send it to a high-quality output device later.

VP-Planner has more print controls than *1-2-3*, Release 1A. From the menus you can select the standard features. You also have the choice of printing page numbers or row and column numbers. There is even a background print feature that lets you work on a spreadsheet on the screen while *VP-Planner* is printing a worksheet or a graph. It is copy protected, but for an extra $10, you can get a nonprotected disk.

VP-Planner has an adequate tutorial in the manual, but interestingly enough, the manual recommends that you pick up a book on *1-2-3* if you want more details. Telephone help is available for $5 for the first 5 minutes and $1 a minute after that.

As a *1-2-3*, Release 1A, clone, *VP-Planner* comes very close to being a perfect fit. But it has much more to offer than a simple spreadsheet. The *dBASE* link is a simple and convenient advantage. The multidimensional database feature opens many new possibilities, although a real database program, such as *R:base System V*, may be easier to use. However, at only $99.95, *VP-Planner* is a bargain.

—Christopher Barr

Words & Figures

Back in the days when *WordStar* was king of the word processing mountain, Lifetree Software introduced an inexpensive word processor called *Volkswriter* and established a reputation for friendly and affordable software. Lifetree's latest spreadsheet offering, *Words & Figures*, preserves that tradition. At a $99 list price, it gives you *1-2-3*, Release 1A, compatibility together with an integrated word processor.

You load *Words & Figures* using a small batch file provided with the package. Lifetree gives you a standard version of its spreadsheet, as well as a smaller version for machines with limited memory. Both have the same features, but the smaller version is split into two programs: one that stays in memory, and one that contains lesser used features that you load when you need them. There is no noticeable difference in performance, and the smaller version frees more than 50K of memory.

You enter your hardware settings in a separate configuration program that loads automatically when you install the system.

OUR REVIEWERS

Merv Adrian is a frequent contributor to *PC Magazine*.
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Mike Falkner is a microcomputer consultant based in Sacramento, Califomia.
Jared Taylor is *PC Magazine*'s West Coast editor.
William A. Taylor is a computer consultant, specializing in artificial intelligence, based in New Hampton, New Hampshire.

PC MAGAZINE FACT FILE

***Words & Figures*, Release 1**
Lifetree Software Inc.
411 Pacific St.
Monterey, CA 93940
(408) 373-4718
List Price: $99
Requires: 256K RAM, two disk drives, DOS 2.0 or later. Graphs can be displayed on the screen if a graphics card is present.
In Short: An excellent *1-2-3*, Release 1A, clone with many Release 2.0 features and a built-in *Symphony*-like word processor. Well-suited for the user who needs simple integration of numbers with letters. Not copy protected.

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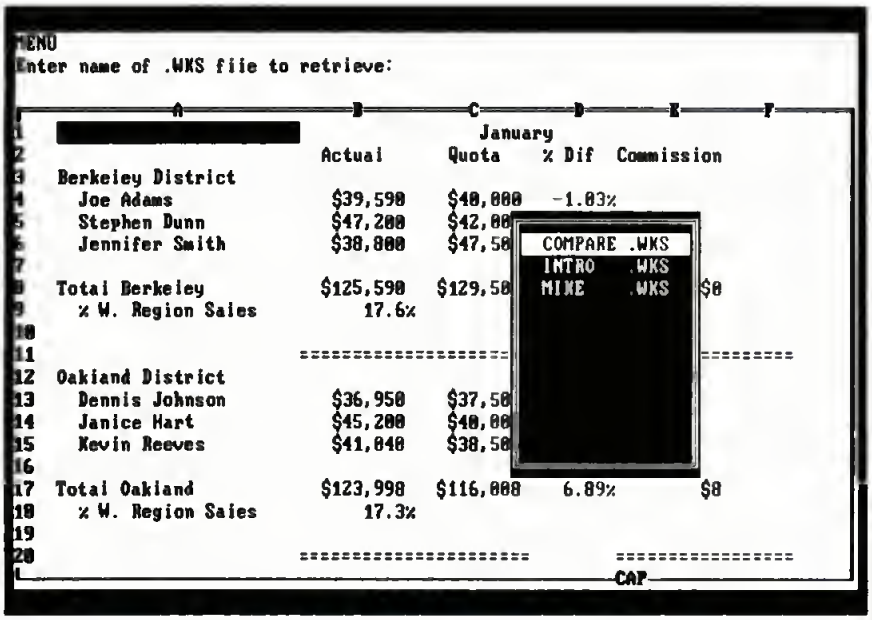

Words & Figures *uses windows to display the names of available files, ranges, and graphs during a File Retrieve. You can use cursor keys and Return to select a name, or you can type in the desired name.*

Words & Figures supports monochrome, color (CGA), Hercules, and Enhanced Graphics Adapter (EGA) displays. In addition, it supports 31 printer manufacturers and numerous printer models. The configuration program loads and runs quickly and can be used as often as needed.

Since *Words & Figures* is both a spreadsheet and a word processor, it begins with a menu for selecting a mode to start with. The word processing option brings up a screen with rulers and margins, while the spreadsheet option brings up a row and column format. You can switch easily between the modes by hitting the Alt-F10 key combination.

The spreadsheet screen is like *1-2-3*'s. The rows, labeled 1 through 20, and the eight columns labeled A through H are not highlighted, however. Lifetree merely lists the row numbers and separates the column headings by double horizontal lines.

Words & Figures is completely compatible with *1-2-3*, Release 1A, and possesses all of the Release 2 features except for the macros. The Slash key invokes the menu command, although the Esc key can also bring up menus. Menu commands can be selected with a cursor key or by the first letter of the option. The first menu includes the Release 1A commands and a new one called Text that switches your screen to the Word Processing mode. Instead of listing names along the third line of the control panel for commands such as /File Retrieve and /Range Name Create, *Words & Figures* displays a window with a vertical list of names that can be selected using a cursor. Although the window doesn't show as much as [F3] does in *1-2-3*, Release 2.0, it is still an easy way to select names.

NEW MENU COMMANDS Lifetree also added a few of its own menu commands, including /Worksheet Column Set, which accepts a width of zero so that the column doesn't show but cursor movement still recognizes it. Another, /Worksheet Audit, displays the contents of all cells in the spreadsheet and indicates any errors or circular references.

Consistent with the rest of the spreadsheet, the database commands are nearly identical to *1-2-3*'s. A third sort key is offered in the Data Sort menu and a new command, /Data Query Select, lets you review records matching your criteria before sending them to an output data range.

In the Spreadsheet mode, the /File Save command saves the spreadsheet portion only in a *1-2-3*, Release 1A, format with a .WKS extension. If the file already exists, the /File Save command asks you if you would like to replace it or back it up by renaming the old file .BAK. In order to save the contents of both the spreadsheet cells and word processing area, you must use the /File Other Save-WAF command, which creates a *Words & Figure* formatted file with a .WAF extension. In the Word Processing mode, /File Save will automatically create the .WAF file.

Like most of the other spreadsheet

EDITOR'S CHOICE

• **Silk**

Everyone knows 1-2-3 *is a wonderful piece of software headed for stiff competition from the upcoming spreadsheets by Microsoft and Borland. In fact,* 1-2-3 *has already met its match.*

Silk *is enough like* 1-2-3 *to make any spreadsheet user feel at home, and it spoils you with features you can't find in the industry standard.* Silk*'s improved graphics, fine use of function keys, interactive help, global search and replace, and easy-to-rearrange worksheet are reason enough to buy. The fact that the list price of $298 is 40 percent less than* 1-2-3*'s $495 is icing on the cake.* Silk*'s many extras do cost you memory and speed but, if you're a serious spreadsheet maven, by now you've equipped your system with expanded memory and a math chip.*

Silk *lacks the massive user base that makes* 1-2-3 *so appealing; when you have a spreadsheet question, a coworker or friend is sure to know the answer if it's about* 1-2-3. *Among word processors,* WordStar *still captures sales for just that reason, even though it's no longer the best. At some point, you have to think about moving onward and upward.* Silk *gives you reason enough.*

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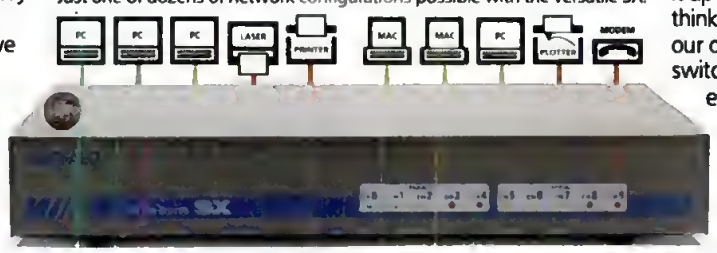

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clones, *Words & Figures* included only the *1-2-3*, Release 1A, keywords, /X commands, and Alt-key combinations in its macro capabilities. To create a macro, keystrokes are placed as labels in cells, and the first cell is given a name using the Backslash key (\) and a letter from A to Z. As expected, typing the Alt key and a letter executes the macro.

Graph settings can be set up for five graph types: bar, pie, *x-y*, stacked bar, and line. Although graphs can be viewed in the spreadsheet, they must be printed by a separate program. To keep the size of *Words & Figures* small, Lifetree created a PrintGraph clone called PicPrint to print the graphs. It supports many printers, including the Apple LaserWriter, and it allows numerous colors, fonts, type sizes, and page sizes.

The word processing portion of *Words & Figures* provides *Symphony*-like word processing capabilities that use spreadsheet menus. Although documents are separated from spreadsheet information and the screen loses its spreadsheet look, you can take values from your spreadsheet and insert them into the document using the Insert Spreadsheet command. Changes made to the spreadsheet will be automatically reflected in the document.

In *Words & Figures* it's easy to switch between spreadsheet and word processing modes.

Words & Figures includes the tutorial as a chapter in its manual, giving you sample models and the keystrokes used to create them. It's good practice once you're familiar with the program, but it offers very little explanation to the beginner.

Although the *Words & Figures* calculation times are slower than those of *1-2-3*, Release 2.0, they are better than those of many of the other clones (see "Performance Tests: Spreadsheet Programs"). *Words & Figures* also lacks some nice features that appear in *1-2-3*, Release 2, such as Release 2's full-screen viewing of filenames, which makes it easier to locate spreadsheets. It would also be nice to be able to print graphs from the spreadsheet. For that, *Words & Figures* requires a separate PicPrint program.

With many of *1-2-3*, Release 2's features, math coprocessor and EMS board support, a smoothly integrated word processor, and a $99 price tag, *Words & Figures* is a value worth looking into.

—**Mike Falkner**

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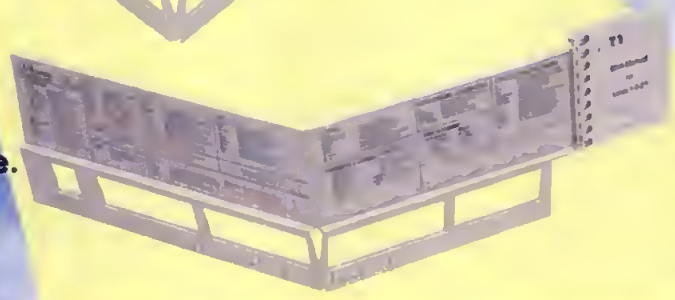

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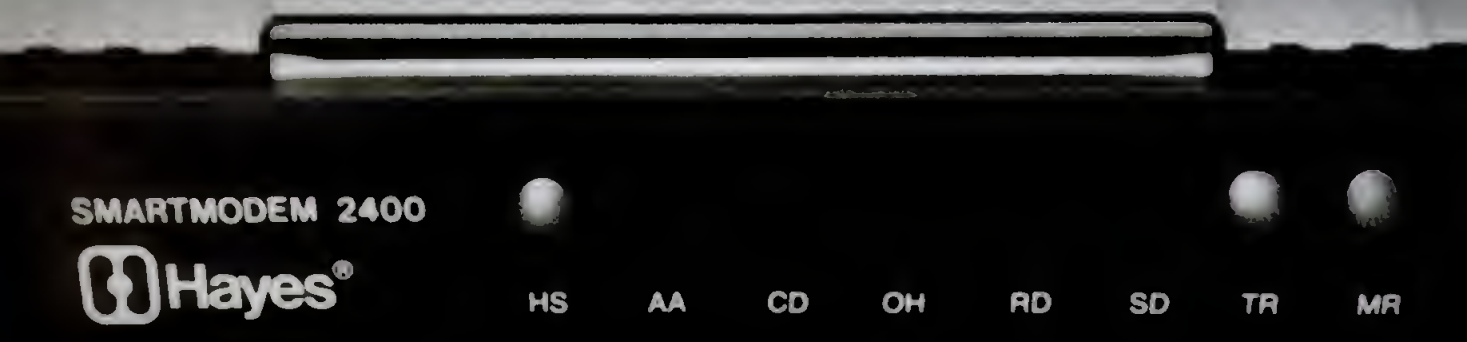

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ANALYZING DATA FROM ALL THE ANGLES

Three 3-D spreadsheet programs—Boeing Calc, microCUBE, and TM/1—put page after page of linked data at your fingertips.

Some of the most recent and interesting challengers to *1-2-3* are the multidimensional spreadsheets—spreadsheets that add depth to the familiar matrix of cells and rows. Programs such as *Boeing Calc*, *microCUBE*, and *TM/1*, each reviewed in this article, give you multiple spreadsheets—spreadsheets that reference each other and that can be read like pages in an electronic book, with each page adding detail and dimension to the page preceding it. *Javelin Plus* offers various "views" of the data (see accompanying sidebar "Javelin Plus: The Spreadsheet Alternative").

A number of traditional spreadsheets—*VP-Planner* and even *1-2-3*—give you the ability to link spreadsheets through a series of special commands. As with cells in traditional spreadsheets, cells in multidimensional spreadsheets are referred to by their address. But these add page numbers. With Lotus's *1-2-3*, the address of the cell in the upper-left-hand corner of the spreadsheet is simply A1. In *Boeing Calc*, the address of the cell in the upper-left-hand corner of the seventh page is 7A1.

Three-dimensional spreadsheets tend to be more compact in design. Pages that support a final worksheet product in traditional spreadsheets must be distributed around the flat environment. In a multidimensional spreadsheet, all supporting work areas can reside below the final product where you can easily reference them if you need to. Reviewing and managing the underlying data is less exhausting.

In the past, multidimensional problems had to be massaged, sculpted, or molded by brute-force cybernetics to be examined in a traditional worksheet. Consider a typi-

cal budget. In a traditional spreadsheet, you'd either cram more detail than you would like into a master worksheet or deal with multiple worksheets and labor over the data and formulas that had to be duplicated. In a 3-D spreadsheet, the first page (or the final page depending on how it's viewed) could contain the total annual budget by category. Each underlying page might represent a month or some other period. Data and formulas in a cell on the first page would be linked to cells on succeeding pages so that changes made in one level of the worksheet would ripple through the entire product.

Three-dimensional spreadsheets give you the ability to link cells in one spreadsheet with cells in another in a single package.

DIFFERENT VIEWS Among the software reviewed here, *Boeing Calc* and *microCUBE* let you view your budget a page at a time. You can also rotate slices of the cube so that you can simultaneously view all periods for a particular category.

The same budget in a 2-D spreadsheet would show categories of income or expense down the side and the months of the year spread across the top. That format isn't bad. It's served us well for some time now. But 3-D spreadsheets represent a frontier for pioneering analysts who see new levels of rippling recalcs as their manifest destiny. This new software gives us flexibility and possibilities we've never known before. As users find ways to put that mix to work, applications for 3-D spreadsheets are certain to grow.

Lotus recognized the appeal of this flexibility when, with *HAL*, it gave us the ability to link cells in one spreadsheet with cells in another—updating one cell updates the other automatically. Three-dimensional spreadsheets give you those capabilities in a single package. But among the packages reviewed here we found that power and flexibility could come at the expense of other features. *Boeing Calc*, for instance, has no graphics abilities. If you want graphics, Boeing will sell you *Boeing Graph* (sold as *Perspective* by 3D Software until Boeing reissued it as *Boeing Graph* when it purchased 3D) at a list price of $350.

Even at that, there's a lot of appeal in the layered look exhibited by *1-2-3*'s big cousins. The 3-D spreadsheets deliver all the analytical ability of their 2-D predecessors and then some. They are well worth the time you'll spend building and brows-

LIES, DAMNED LIES . . .

Spreadsheets are wonderful tools. So many businesses now depend on them so completely that it's hard to remember the bad old days when we did things by hand. But the spreadsheet that is your trusted friend when you quantify the past may be your worst enemy when you predict the future.

Spreadsheets were designed to help people do repetitive arithmetic. Record-keeping and accounting are a lot easier when a computer does the math. But before long, people started using spreadsheets to play what-if games and to build forecasting models. The day of the cheap computer projection had arrived. Now anyone with a PC and a little imagination can do sophisticated forecasting that used to be possible only with mainframes.

Forecasting fever has gripped corporate America. Not even the fast-trackers can now walk into the boss's office with nothing but an idea; they have to have a fistful of numbers. In some offices, you can hardly order a new coffee machine without running a 3-year costs/benefits analysis. All business decisions, large or small, must be put to the numbers test. Make a few assumptions, build them into a model, and let 'er rip!

In large companies, projections are run by specialists who may know something about forecasting. But in small companies, they're done by amateurs. All of us have some notion of whether an assumption is plausible, but how many *1-2-3* or *SuperCalc* users know anything about probability? Do they know whether forecast results will be more accurate or less accurate as they increase the number of variables? Have they any idea how to gauge the accuracy of their results? Probably not.

But the beauty of spreadsheet forecasting is that technical competence doesn't matter. Spreadsheets have done away with the "objective" forecast. Since anyone can now do projections, who's going to wait for an independent expert to do one? It's the person who cares most about a project—its most ardent supporter—who now does the projection.

Is he going to do a coolly unbiased forecast? Of course not. He probably thought up the project; he loves it like an only child. His projection is not going to be an aid to objective decision-making; it's going to be a lawyer's brief. A lot of spreadsheet "forecasts" are thus not forecasts at all. They're justifications for something somebody has already decided to do.

The trick is to build a forecasting model backwards. The forecaster knows what the results of the projection have to be: fat profits. So he tweaks the assumptions and tunes the variables until the "forecast" looks plausible and gives the right results. With creative fiddling, any project can be made to look profitable. Accountants have always been able to cook the books after the fact; now you can cook them in advance.

Some people are fooled by this. They don't understand that letting an advocate run a projection is like letting a criminal write a law. They don't realize that speculative assumptions can't produce results correct to the fourth decimal place. Even

if they do, they may think they have to go along with the ritual of numerical analysis. It's with columns of figures that we offer up our prayers to the gods of capitalism.

LOOKING AT THE DOWNSIDE At the same time—and more usefully—not even the most tendentious forecaster can completely ignore costs, losses, competition, or bad debts. He may finesse the unpleasantness with an artful choice of assumptions, but at least he has to think about it. And that may be the sole value of most projections: forecasters must identify costs in order to be taken seriously. They may then go on to eliminate them by sleight of hand, but they've had to worry about them.

There's another nasty issue that spreadsheet forecasters don't like to talk about: mistakes. A persuasive forecast has lots of variables—the more the better. A large number of variables makes it look as though the forecaster thought of everything, at the same time that it gives him many more ways to fudge the results. But even apart from fudging, handling multiple variables can be fiendishly complicated. The more numbers a forecaster has to juggle, the more he's likely to drop. The computer won't ever make a mistake, but he will.

Many mistakes are never found. Once a model has more than a dozen or so variables, it's too complicated to troubleshoot just by working backwards from results. Somebody has to go over the whole thing, formula by formula, to make sure everything's right. That's such an awful bore that hardly anyone does it. Spreadsheet auditing programs make this chore much, much easier, but since their sales are only a fraction of *1-2-3*'s, it's a good guess that few people are using them. These programs also cannot spot faulty logic. Only smart, patient people can do that.

There are businesses, like banking or accounting, that live on tedious, error-prone arithmetic. They have come up with formal procedures to catch mistakes. Amateur forecasting is even more prone to error, but it hasn't developed any standards of accuracy and probably never will.

A spreadsheet program and a microcomputer are powerful tools that can be used for great good. But if you're not careful, these same tools can be used against you. So the next time someone hands you a projection, be sure to ask a few questions.

Find out who built the model. Chances are it was someone with a vested interest. If the model is at all complicated, find out how carefully it's been checked. Has anybody but the original forecaster looked it over? If no one has, it's probably got mistakes. Finally, you should pay more attention to costs than to revenues. Revenues are mostly fantasy, but costs can be estimated. Make sure they're realistic.

Whatever you do, don't assume that just because somebody used a computer, the results are somehow unassailable. As Benjamin Disraeli pointed out long ago, there are lies, damned lies—and computer projections.—**Jared Taylor**

ing through their pages. The more adventuresome among you may like these spreadsheets enough to buy one.
—**William H. Stewart**

Boeing Calc

Boeing Calc, a $399 program from Boeing Computer Services, is an unusually large 3-D spreadsheet similar to *1-2-3*. *Boeing Calc* reads and writes *1-2-3* and *Symphony* worksheets and executes commands in Lotus-like ways. *Boeing Calc* occupies about 415K bytes of RAM, but unlike with *1-2-3*, memory is not a consideration when working with large spreadsheets. In *Boeing Calc*, spreadsheets are called Workpads and are maintained in memory until the shell reserved within RAM is full. Then *Boeing Calc* creates a temporary file on disk to store the overflow.

Because *Boeing Calc* uses virtual memory, it is capable of creating huge Workpads—16,000 rows by 16,000 columns by 16,000 pages. The Workpad is limited by the disk space available and the 32 megabytes of disk space addressable by DOS.

Copying and moving a range of cells is slower in *Boeing Calc* and other multidimensional spreadsheets than it is in *1-2-3*. The large 3-D environments also slow performance on number-crunching tasks, partly because of the complexity of the formula relationships the programs deal with. Waiting on the program can be tedious, but if you need multidimensionality, it may be a worthwhile trade-off.

The multidimensional spreadsheets reviewed here generally take different approaches when creating multidimensionality. Where *Boeing Calc* uses virtual memory, *microCUBE* is memory resident like *1-2-3*.

Our performance tests were designed to compare the 2-D capabilities of all the packages reviewed here. So, to get a feel for *Boeing Calc*'s speed and file size requirements in the third dimension, we translated into *Boeing Calc* a basic budget worksheet created in *1-2-3*. This budget was contained in a range of 36 columns by 126 rows. Using commands much like *1-2-3*'s, we copied the range to 12 underlying pages. Once the Copy command was invoked, there was plenty of time to sit back and relax. Copying the two-dimensional spreadsheet onto the 12 underlying pages simply created two-dimensional spreadsheets on each receiving page. The copy process did not create a formula relationship between pages, but it did adjust formulas to indicate on which page you would find them. However, when moving a range of cells from a working two-dimensional page to other pages, *Boeing Calc* created formula relationships to maintain the mathematical integrity of the spreadsheet.

MASS STORAGE Saving all this to a file required a remarkable 616K bytes of disk storage. It is interesting that the *1-2-3* file that was the starting point for this experiment required 34K bytes. If Lotus's *HAL* had been used to link the 12 34K-byte files, it would have required about 406K of

Boeing Calc *provides a powerful 3-D work environment and is easy for* 1-2-3 *veterans to learn. It reads and writes active* 1-2-3 *and* Symphony *worksheets and has a command structure very similar to that of* 1-2-3.

disk space. You have to link the worksheets in *1-2-3*, however. *Boeing Calc* automatically makes the links.

Recalculating every change you make in a large Workpad can be time consuming. The program provides for manual recalculation using the F9 key, just as *1-2-3* does. A Range command assists by offering the ability to recalculate a specified range of cells. This speeds things up considerably because *Boeing Calc* doesn't have to search all dimensions for formulas to evaluate.

You can move from page to page by first setting the Page mode to Pad mode with the F4 key. When in Pad mode, the PgUp and PgDn keys scroll through the third dimension. The first movement through the third dimension requires a disk access to pull the page you want into memory. Once you scroll all 12 pages, moving around all dimensions is as easy as in the two-dimensional products.

Translating *1-2-3* files is easy with the /File Import command. You can translate files from *1-2-3* (Releases 1A and 2), *Symphony*, ASCII, and .DIF formats. Except for *1-2-3* macros, the translated spreadsheets are completely operational within *Boeing Calc*.

Boeing Calc doesn't have keyboard macros. Instead you get command files, which are started with the command /Environment Macro Keep. This starts recording subsequent keystrokes for storage in a file named by the user. The command file is executed by invoking the command /Environment Macro Use.

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***Boeing Calc*, Version 3.00E**
Boeing Computer Services
Micro Software Products
P.O. Box 24346 M/S 7W-01
Seattle, WA 98124
(800) 551-0800
List Price: $399
Requires: 512K RAM, hard disk drive, DOS 2.0 or later.
In Short: A slow but large and powerful 3-D spreadsheet with a *1-2-3*–like command structure. Not copy protected.

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A local area network version of *Boeing Calc* is available for $795. The LAN version lets users share information in a common Workpad. As already mentioned, *Boeing Calc* has no graphing abilities. Instead, Boeing offers *Boeing Graph*, a true 3-D graphics package that sells for $350. *Boeing Graph* will import *Boeing Calc*, or other spreadsheet data, for use in graphs that are truly three dimensional, unlike the two-dimensional graphs you get in 3-D perspective with programs such as *MicroSoft Chart*.

Even with its deficiencies (no keyboard macro language or graphing abilities and its inability to name cell ranges) *Boeing Calc* is a good multidimensional spreadsheet. Its translation capabilities are flexible and its documentation is helpful and easy to read and understand. Any *1-2-3* user will have little trouble adapting to the third dimension, and, at $399, it is an excellent value.—**William H. Stewart**

microCUBE

Familiarity with Lotus's *1-2-3* or its lookalikes isn't much help when you begin to work with *microCUBE*, a $600 3-D spreadsheet from McDonnell Douglas Communications. It helps to have an understanding of such general spreadsheet concepts as spreadsheet structure or cell referencing, but aside from getting to a command line by using the Backslash key, very little is like *1-2-3*.

microCUBE's Spreadspace is 255 rows by 255 columns by 255 pages, and it includes some unique features. Among them is Visual Audit, a time-saving feature that highlights each value that is changed when calculations are complete. Visual Audit also color codes values differently, depending on whether they are input values, recalculated amounts, or values that remain unchanged.

GOAL SOLUTION Goal Solution is another excellent feature. Imagine building a financial forecast model in the traditional fashion: First all the variables are identified and the formulas created; then, if variables are altered, the result is updated. This is just what we wanted, right? Well, maybe, maybe not!

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System Requirements: IBM PC, PC/XT, PC/AT or compatible (*DIAMOND* is not copy protected) Memory Requirement: 320K Minimum

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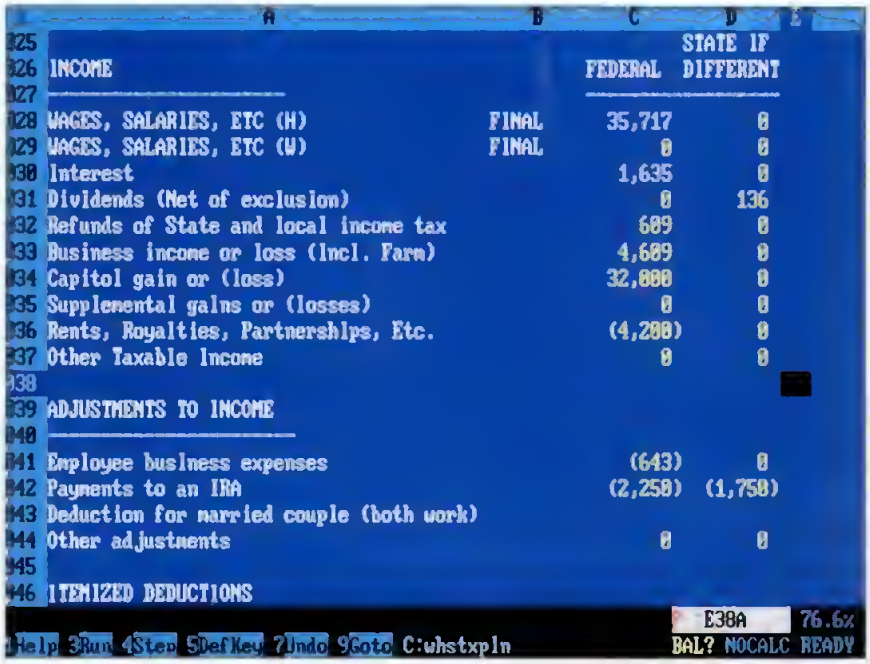
CIRCLE 292 ON READER SERVICE CARD



	A	B	C	D	E
25				STATE IF	
26	INCOME		FEDERAL	DIFFERENT	
27					
28	WAGES, SALARIES, ETC (H)	FINAL	35,717	0	
29	WAGES, SALARIES, ETC (W)	FINAL	0	0	
30	Interest		1,635	0	
31	Dividends (Net of exclusion)		0	136	
32	Refunds of State and local income tax		609	0	
33	Business income or loss (Incl. Farm)		4,609	0	
34	Capitol gain or (loss)		32,000	0	
35	Supplemental gains or (losses)		0	0	
36	Rents, Royalties, Partnerships, Etc.		(4,200)	0	
37	Other Taxable Income		0	0	
38					
39	ADJUSTMENTS TO INCOME				
40					
41	Employee business expenses		(643)	0	
42	Payments to an IRA		(2,250)	(1,750)	
43	Deduction for married couple (both work)				
44	Other adjustments		0	0	
45					
46	ITEMIZED DEDUCTIONS				

E38A 76.6%

1Help 3Run 4Step 5DefKey 7Undo 9Goto C:whstxpln BAL? NOCALC READY

This spreadsheet was imported to microCUBE *from a* 1-2-3 *file. Unfortunately,* microCUBE*'s import utility can't translate all* 1-2-3 *functions into equivalent* microCUBE *functions. The functions that are not recognized are written as text strings.*

the same model can be used. However, rather than altering variables and viewing the changed result, this feature lets you set the desired goal, lock certain variables, and directly solve other components required to achieve the final result. Then, *microCUBE* indicates the changes in one color and assigns another color to the items you indicate should be static. This is an excellent use of color and makes analysis of the model much easier.

Working in *microCUBE*'s third dimension is much like working in its second. You use the PgUp and PgDn keys to move from page to page. A relationship between the cell and the page it is on exists just like the relationships that exist among cells identified by the intersection of rows and columns.

Visualize a cube made up of cells—something like a Rubik's Cube. In this multidimensional environment, you can view different relationships of the same data by rotating parts of the cube. Cells exist side by side in columns and behind one another in columns. You can break out a column through its depth and rotate it so you can see the underlying cells side by side. You can also do this with rows. This flexibility is especially useful.

As in *1-2-3*, columns are identified by letters, and rows are identified by numbers. *microCUBE* also uses letters to identify pages, so the upper-left-hand cell of page 3 would be identified as A1C, with C indicating the third page. *Boeing Calc* refers to the same cell as 3A1. *Boeing Calc*'s numeric references for pages somehow seems more logical. When you are working deep within the cube, the letter references become more obtuse; page 27, for instance, is AA in *microCUBE*.

Function keys are used well in *microCUBE*. Their functions change at various levels within the command structure. What each key does is always indicated at the bottom of the screen. In fact, unlike *1-2-3* and many others, all the command information, cell addresses, and other useful information are shown at the bottom rather than at the top.

In *1-2-3*, you can use an arrow key instead of the Enter key to enter data into the worksheet; it saves keystrokes by entering the information and moving the cursor toward the next input cell at the same time. *microCUBE* will put data into a cell only when you use the Enter key. However, you can set the cursor to move one cell in any direction after striking the Enter key. This includes paging in or out through the depth of the cube.

microCUBE includes a utility that translates *1-2-3*, Release 1A, with the files (.WKS extension) into files that can be read by Spreadspace. This works reasonably well, but some complex spreadsheets can't be translated. This could be a major disappointment for anyone changing from *1-2-3* to *microCUBE*, especially if there are many spreadsheets to transfer. The utility doesn't just drop things it can't convert; rather, it translates them into text strings and leaves them in the cell where they belong.

The documentation is a fairly impressive three-volume set (not counting booklets on installation and file translation). One volume is devoted to tutorials, another to the Spreadspace, and the third to Graphics, Communications, and EXEC, a programming and macro language built into *microCUBE*. The table of contents could provide far more entries, as well as cross-referencing from generic terms to *microCUBE*'s specific terms.

SO MANY CELLS Practically speaking, the more than 16 million cells *microCUBE* sports in its cubed structure are not really usable because of memory constraints. This is true even though memory is allocated to only those cells that are being used. Also, if you're creating large work areas,

PC MAGAZINE FACT FILE

microCUBE, **Version 2.0**
McDonnell Douglas Communications
5299 DTC Blvd., #1400
Englewood, CO 80111
(303) 220-6033
List Price: $600

Requires: 512K RAM, two disk drives, DOS 2.0 or later.

In Short: Slow speed and a cumbersome page-numbering scheme are offset by powerful features and the ability to analyze slices of information stacked through the cube. Not copy protected.

CIRCLE 661 ON READER SERVICE CARD

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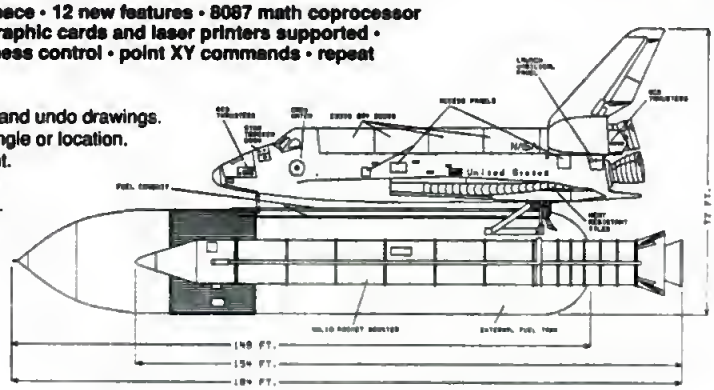

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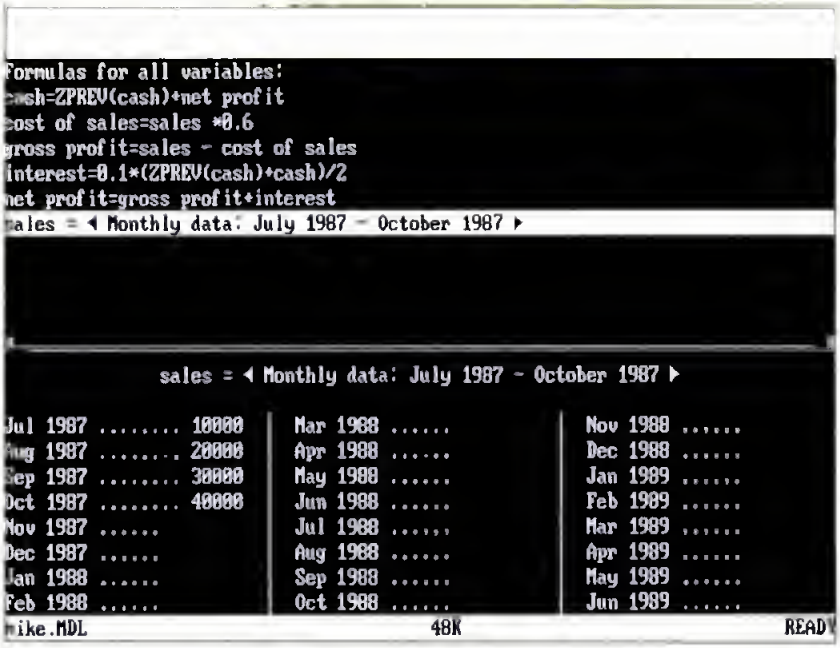
CIRCLE 477 ON READER SERVICE CARD

JAVELIN PLUS: THE SPREADSHEET ALTERNATIVE

Javelin Plus, a new version of the modeling package from Javelin Software Corp., is not a typical spreadsheet. In fact, it's really not a spreadsheet at all. Ever since its debut in 1985, the *Javelin* package, which lists for $249.95, has been touted as a serious business analysis tool that bucks the traditional *1-2-3* approach.

Released in May, *Javelin Plus* offers more than 75 new features not included in the traditional *Javelin* program. Javelin Software is continuing to support both programs. The earlier *Javelin*, Version 1.1, lists for $99.95. The *Plus* version contains new graphs, "snap and building blocks" (a separate disk containing specific working models for such things as what-if projections and multiple regressions), date variables, a facility that operates as a database, and a template model for mailing lists that can sort by city, ZIP code, and so on.

To understand *Javelin*, you've got to throw away your preconceived ideas about spreadsheets. Models built in *Javelin* are made up of variable names instead of rows and columns. These variables can be constants, a series of data elements, or part of an equation that relates variables to other variables. You can create your model from the top down by defining the equations first or from the bottom up by entering data first and creating the equations later.



In Javelin Plus, *variables are entered as English words. Variables can be related to other variables, or they can be loaded with data in the Table view, as shown in the window at the bottom of the screen.*

NO TRUE DIMENSIONS *Javelin* is not a true multidimensional spreadsheet, but it bears a much closer resemblance to one than it does to traditional spreadsheets. It presents everything on the screen in one of ten "views." The screen is split into two windows in which any of the ten views can be shown. Formulas and values are entered on the top line of the screen, and messages are shown on the second line. The Slash key (/) reveals eight pull-down menus that provide a variety of commands to manipulate each view. As in *1-2-3*, commands can be selected with cursor movement keys or by typing the first letter of each choice. Some commands require either a second pull-down menu that overlays the first or a data entry screen where various options can be set.

You usually start your model with the Formulas and Diagram views. The Formulas view shows the equations that you have entered for each model relationship. For example, you could enter GROSS PROFIT = SALES − COST OF GOODS, and *Javelin* would show the formula on the screen along with a line showing SALES and COST OF GOODS as undefined. In the Diagram view, *Javelin* shows SALES and COST OF GOODS connected by lines, pointing to GROSS PROFIT, with the formula displayed below it. With both of these views displayed, you can see all the elements making up the model, as well as a pictorial view of the model.

At some point, you must enter some data into the model; the Table view facilitates this process. *Javelin* assumes that most data is related to some period of time, and the Table view displays a screen with dates followed by prompts for data. The time periods can be changed from monthly to daily, weekly, quarterly, or yearly; you can also choose a customized time period or no time relation at all. Once you set up the starting date, it is very easy to fill the model with data. There is no limit to the number of time periods, and *Javelin* expands automatically to accommodate more data.

Once the information has been entered, you can use the Chart view to display the data as a chart with the date along the *x*-axis and the amounts along the *y*-axis. Instead of being just a static view, the Chart view allows you to cursor over to a data point or cursor up or down to change the value of the data and then watch the model change in the other window after you calculate it. The Quick Graph view is much like the Chart view.

You can display and enter data points by using cursor movement keys in a line chart. However, the Quick Graph uses the entire screen, and you can't watch other elements of the model change.

Javelin's commands, like those in *1-2-3*, help you manipulate and control the model. The Define command controls settings, default formats, and the characteristics of variables and views, while the Clear commands remove variables and views from the model. The View commands determine the view that will display in each window, and the Window commands control the number of windows (one or two) and their size. Worksheet commands change the look of the spreadsheet and allow you to copy data, import and export files, sort, and define variables.

MANY VIEWS Often, a spreadsheet grows quite large, and it is helpful to document the model. *Javelin*'s Notes view allows you to attach free-form notes to any variable in the model. In addition, the Errors view helps you quickly resolve logic problems in the model by displaying all variables that haven't been defined or that have a date conflict.

The Worksheet view brings back the familiar look of *1-2-3*. A border area on the left is reserved for any of the variable names shown in the Formulas view. Dates are then entered along the top, and *Javelin* automatically displays the data matching the intersection of the rows and columns. You can create many worksheets with one model showing only those formulas and dates that you want to show.

Once you have your data in place, you can use the Graph view to create one of eight graph types, including line, bar, stacked bar, pie, and *x-y* charts. Graph settings are entered into a settings screen in which you assign variables, labels, legends, and scale. Printing is done from within *Javelin* with the /Print Graph command.

Javelin can import and export a variety of file formats including .WKS/.WRK/.WK1, .DIF, SYLK, and .PRN. However, *Javelin* only reads and writes text and numbers, not formulas, so don't expect to convert all of your *1-2-3* spreadsheets with just a /File command. In addition, *Javelin* suggests that you split your spreadsheet file into three separate files and import the variable names first, the column headings next, and then the data to save memory. It may just be easier to reenter the spreadsheet.

The Macro view gives you much the same capabilities as *1-2-3* macros have. Keystrokes are entered into the view, and cursor movements and commands are preceded by an at-sign (@). You can create menus, branch, test conditions, ask for input, and store remarks. The Macro views are given a name and are executed by hitting Alt-F7 and then entering the view name. If the view has a single character name, Alt and that character will execute it.

The Print command simply sends the current view to the printer. You can control margins, insert headers and footers, and use setup strings to change the printer characteristics. The same command prints graphs, spreadsheets, and all the other views to the printer, screen, or a disk file.

The database feature seems forced into the design of the overall package, but it gets the job done. Records are stored as rows with the same row name listed down the border on the left. The column headings are the field names, and you must define a custom period with no base date to suppress the automatic time-series headings. You can include database information in your model by creating variables that sort data and select records based on criteria.

Javelin is a complex package, and its documentation doesn't do it justice. The reference manual contains all the basic information, and it includes many good examples of screens and commands. However, it covers most items briefly, and you often have to switch back and forth between sections to solve a problem. The Customer Service department is very helpful, and you may have to rely on it until you've mastered *Javelin*.

SPECIALIZED FUNCTIONS The package contains many options and possesses many capabilities. *Javelin* is a powerful analysis tool that can handle formulas quickly and display the output in many different views. More than 100 specialized functions perform just about any kind of task that you might need. Because of its complexity, it's a tough package to master. If you switch from it to *1-2-3*, you won't be able to import much data from your spreadsheets, so you will have to start over. You will need close to 500K bytes just to load the program, so memory-resident programs like *SideKick* could crash your system. If *Javelin* is what you want, an AT with an EMS board is a good idea.

Javelin Plus won't replace your spreadsheet for doing quick-and-simple tasks. However, it is a powerful, self-documenting, graphical analysis tool that makes it easier to define and evaluate complex time-series models.

—Mike Falkner

PC MAGAZINE FACT FILE

Javelin Plus
Javelin Software Corp.
One Kendall Sq.,
Bldg. 200
Cambridge, MA
02139
(800) 528-3546
(617) 494-0400

List Price: $249.95

Requires: 512K RAM, two disk drives (5¼ or 3½ inch), DOS 2.0 or later. Graphs can be displayed on the screen if a graphics card is present.

In Short: A powerful modeling package built for time-series analysis. A bit overpowering at first, but a unique alternative to the *1-2-3* approach. Not copy protected.

CIRCLE 662 ON READER SERVICE CARD

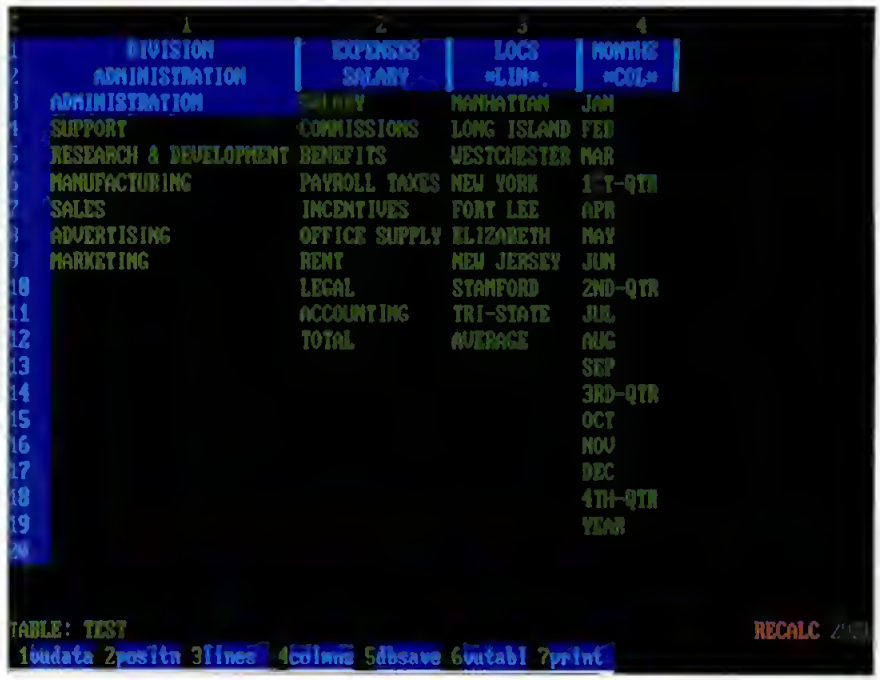
you better be using a fast machine because calculation times in our performance tests were considerably slower than the same test in Release 2.01. However, calculation times compared with 1-2-3 may be misleading: they don't consider the benefits received in exchange for some speed. Speed degradation is a trade-off for Goal Solution. *microCUBE* first must make a pass through the spreadsheet to determine if Goal Solution is invoked, then it makes another pass in order to evaluate the cells. We considered Goal Solution well worth the reduction in speed.

Although *microCUBE* isn't for everyone, it is an impressive package with some innovative and extremely useful aids for those who are interested in 3-D spreadsheets. McDonnell Douglas recently reduced the retail price from $1,200 to $600, making it an excellent value.

—William H. Stewart

TM/1

With eight dimensions and a tabular database management system to organize and analyze data, Sinper Corp.'s *TM/1* (*Table Manager/1*) delivers much more than what most of us have learned to expect from spreadsheets. This high-end spreadsheet, though it's been on the market for over a year, hasn't gotten much public attention. We're not sure why. Its power and flexibility do not come cheap but, even at its list price of $795, it is an excellent investment in spreadsheet firepower.



TM/1 lets you define multidimensional tables and view their components. Locations and month dimensions are defined here as columns and rows, while Division and Expenses are localized to specific entries. As a result, the data shows Administration's Salaries for all locations and months.

The concept behind *TM/1* may be difficult to grasp, but its everyday use is relatively easy. You see all of its available options and functions at the bottom of the screen. Help screens are indexed for easy searching, but they are not context sensitive and they do not supply many practical examples. When they do, the examples are often wordy or confusing.

Like traditional spreadsheet packages, *TM/1* gives you a large worksheet area (9,999 by 9,999 cells), a number of functions, plus macro commands and keywords for those who want to automate their daily tasks. It also lets you work with a split screen, import data from other packages, and utilize a math coprocessor if you have one. *TM/1* is driven by function keys that are explained in a menu bar at the bottom of the screen.

TABULAR DATA Unlike traditional spreadsheet packages, *TM/1* maintains data in tables and formulas within worksheets. *TM/1*'s worksheets can reference and manipulate any element within the tables. This table management feature, combined with *TM/1*'s multidimensionality, lets you design more-flexible applications into your spreadsheet by letting you create one application for more than one set of data, as well as change data without altering the model and vice versa.

Because traditional spreadsheet packages glue the data to the cells, power users usually end up with either a large model that duplicates data or a number of smaller models that require continual reconciliation. Traditional spreadsheets also give you a worksheet area limited to two criteria, such as months and expenses, so tracking something like department budgets requires you to set up identical worksheets in different areas. If you want to make a global change in expenses, you must make the change in each of the separate worksheets.

TM/1 avoids these problems. Its multidimensionality lets you create one worksheet that can apply to all departments. Since the data is maintained in tables and a table is defined in terms of dimensions, you can construct an application to view how much money was spent in a given month by a given department for a given purpose in a given year, then check that

EDITOR'S CHOICE

PC MAGAZINE FACT FILE

TM/1

TM/1
Sinper Corp.
8901 Tonnelle Ave.
North Bergen, NJ 07047
(201) 662-7999
(201) 822-1596
List Price: $795
Requires: 256K RAM, two disk drives, DOS 2.0 or later.
In Short: An eight-dimensional spreadsheet program that uses table management to keep data and formula separate. *TM/1* is perfect for anyone who uses a spreadsheet for more than a few simple calculations. Not copy protected.

CIRCLE 660 ON READER SERVICE CARD

It's a Win-Win with Open Access II
The Most Powerful Database and Spreadsheet Available in An Integrated Package

The arguments for integrated software used to be convenience, ease of use, and shortened learning curve. The argument against it was no power. The argument is over. According to our users, the primary reason for their purchase of Open Access II is the power of the relational database and the spreadsheet with 3-D graphics, followed by convenience and ease of use. And, by the way, this database and spreadsheet are integrated with a word processor, communications and desk accessories.

Nose-to-Nose Comparison Chart

	Database	Form Query	Report Generator	Query Processor	Relational Database	Graphics	3-D Graphics	Spreadsheet	Goal Seeking	Work Processor	Communications	Time Management
Open Access II	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Symphony	✓	✓	✓			✓		✓		✓	✓	
Framework	✓		✓	✓		✓		✓		✓	✓	

What's New in Open Access II

Meeting the challenge of advanced hardware technology, Open Access II update version 2.05 includes graphics drivers for the IBM Personal Systems/2, extended memory support, math co-processor support (8087/80287) and 37 other additions and alterations.

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CIRCLE 127 ON READER SERVICE CARD

Unlike traditional spreadsheet packages, *TM/1* maintains data in tables.

figure against the amount of money that was actually budgeted for that same situation, as well as the amount that was spent in previous years. You can do this analysis with traditional worksheets, but only with a lot of linking: shoehorning, cross-referencing, data and formula duplication, and data lookups.

In *TM/1*, you define the dimensions, assign them to a table, enter or import data, and design the worksheet applications. You define a dimension by listing its elements (January, Office Supplies, and so forth) and its characteristics (calculated or weighted). You define the dimensions it includes: a budget table, for example, could include years, months, expenses, and departments. You can include a dimension in more than one table. You then enter, import, or calculate your data from within a worksheet.

Because *TM/1* does not lock data into a cell, figures can be referenced from more than one worksheet and, if you update one, all the related tables will be affected. Simply by adding or deleting dimensions, you can also reconfigure tables without losing data.

FORMULA COMMANDS You can use element names as worksheet labels in *TM/1* by adding one of three commands to the cell's formula. The DB command lets you import the figures to your spreadsheet or export them to your database. The DFIRST command copies the first element of a given dimension into a cell, and the DNEXT command imports the rest. Combine this multidimensionality with range pointing, and you can use the same worksheet for different projects. For example, you could write a formula to access the data within a table, leave the actual element name in one cell, and then point to it. So, by labeling your rows and columns with the expenses and time dimensions, the same worksheet serves multiple uses.

1-2-3 veterans may find *TM/1* disconcerting at first because it makes them design functional tables and appropriate worksheets. If you prefer, you can use just the worksheet module. But if you do that, you might as well stick to *1-2-3* because you won't be using the program's capabilities.

TM/1's method of labeling cells is also unfamiliar. In place of the familiar standard of using letters for columns and numbers for rows, *TM/1* uses only numbers and orders them by row/column instead of column/row. As a result, cell A20 in *1-2-3* is [20,1] in *TM/1*. (A Sinper spokesman, however, said the company plans to release a version that will let you switch to the old standard if that's what you want.) Finally, while *TM/1* supports huge spreadsheets, its default worksheet area is only 20 columns by 40 rows. You will have to insert the additional columns and rows when needed.

But *TM/1*'s differences can also be very attractive. The program lets you designate secondary paths to locate files and will allow you to build applications as large as 32 megabytes. You can also define a default path for paging files located in virtual memory, and you can address data by a name rather than by a cell location—1985 April Sales West rather than BZ279. *TM/1* imports .WKS, .DIF, *dBASE*, and ASCII (comma delimited and fixed length) files and supplies 69 functions for mathematics, trigonometry, statistics, string manipulation, finance, lookups, and time and date calculations. Its macro language includes 41 keywords and commands for automating keystrokes, executing subroutines, requesting user input, issuing error messages, selecting dimensions, retrieving and storing variables, seeking goals, and executing AUTOEXEC worksheets. Although the macros are kept in worksheets, you can link them.

Sinper seems to have overlooked nothing in developing *TM/1*. The only disappointments you're likely to find here are in the help screens and in its graphics capability. Graphics are displayed in black and white, but in just two dimensions, a shame considering the program's multidimensionality.

TM/1 is a powerful and flexible system, and anyone in need of serious spreadsheet analysis should definitely investigate it.—**Vincent Puglia**

PC MAGAZINE EDITOR'S CHOICE

• **TM/1**

While 3-D spreadsheets give you obvious advantages over 2-D spreadsheets, as a group they lack some of the 2-D spreadsheets' finesse. Sinper Corp.'s TM/1 *is the most powerful and versatile of the multidimensional analysis tools. It gives you up to eight dimensions in a single table and lets you access data from as many as 60 different tables at once. If you're used to* 1-2-3*'s style,* TM/1*'s style may take some getting used to, which may explain* TM/1*'s modest acceptance in its 3 years on the market. But as multidimensionality becomes more familiar to users,* TM/1*'s advanced features become easier to grasp and easier to use.*

If you simply must have a spreadsheet that resembles 1-2-3 *with a third dimension added, both* Boeing Calc *and* MicroCUBE *should fit the bill, although they're not as elegant in three dimensions as* 1-2-3 *and* Silk *are in two.*

Finally, Javelin Plus *bears scrutiny if you're heavily involved in time-series analysis and don't care that the tool you're using little resembles a 2-D or 3-D spreadsheet.* Javelin *is a wonderful supplement to, not a replacement for, traditional spreadsheets.*

Mike Falkner is a microcomputer consultant based in Sacramento, California. Vincent Puglia is a frequent contributor to PC Magazine. *William H. Stewart is a partner in the accounting firm of Price & Paige in Clovis, California.*

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CIRCLE 272 ON READER SERVICE CARD

A 1-2-3 WISH LIST

Three PC Magazine editors describe what 1-2-3 needs next time around if Lotus intends to remain king of the hill.

Unless you subscribe to the software equivalent of the immaculate conception, you're likely to agree that no program is beyond improvement. The more you use a product, the more you notice its shortcomings. Lotus's *1-2-3* is no exception.

1-2-3 has been coasting. Release 2 is almost 2 years old now, and it wasn't a quantum leap beyond 1982's Release 1.

Three *PC Magazine* Lotus fanatics recently compiled a wish list for the next release of *1-2-3*, which is due in the first part of 1988. West Coast editor Jared Taylor (editor of Spreadsheet Clinic), contributing editor Jim Seymour, and executive editor Bill Howard divided their list into Must Haves, Ought to Haves, and Nice to Haves.

You could call this a wish list for any spreadsheet, but even if *Silk* is better all-around, even if *SuperCalc* has such wonderful graphics, and even if *Excel* will make laser printers jump through hoops, the fundamental truth remains that on a PC, spreadsheet equals *1-2-3*.

"MUST-HAVE" FEATURES

Intelligent linking of multiple spreadsheets (and/or 3-D). That's when you want to pluck information from several spreadsheets—for instance, sales figures from your nine regional offices—and roll it into one master spreadsheet. The /File Combine Copy consolidation command is too limited. Even lowly *Multiplan* handles linking with aplomb; you shouldn't be forced to buy *HAL* or Intex Solutions' *XYZ-Consolidate*. The relationships among spreadsheets should be printable for an audit trail, since it's easier to juggle a half-dozen sheets of paper than load and unload multiple worksheets. Better yet, you should be able to layer the worksheets in one 3-D spreadsheet, as in *microCUBE* and *Boeing CALC*.

A Learn mode for macros. If *1-2-3* doesn't do it this time around, advantage *Excel* . . . and *SuperCalc*, and Borland's *Quattro*, and even *Advanced VisiCalc*.

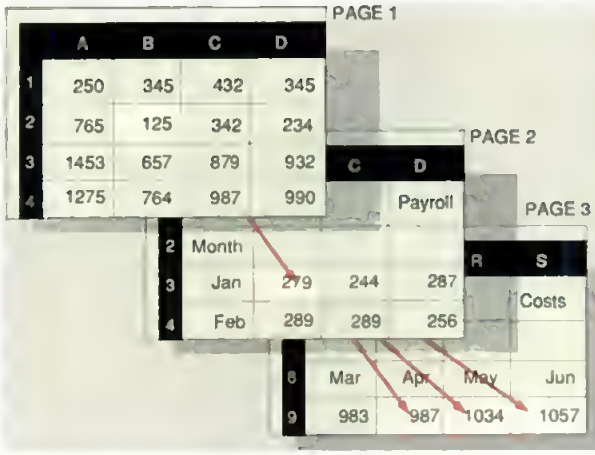
Intelligent backup. At the very least, you should be able to save the previous version as FILENAME.WKB. And if you can spare the disk space, you should be able to make multiple audit copies—for example, FILENAME.WKB, .WKC, .WKD, and so on—signifying major transition points in the spreadsheet. If so, you should be able to make mini-saves (to guard against a power failure or system crash) that don't push the audit stack down a level except when you specify.

Auto-save to disk. At user-defined intervals; plus a way to disable the autosave.

Meaningful mouse support. *1-2-3* doesn't need a mouse, but there are times when it helps. The add-on mouse menuing systems (the best are from Microsoft and Logitech) aren't as good as a program built from the ground up to work with a mouse (if you want to work with a mouse).

Better printer support. No self-respecting word processing program forces you to look up escape codes. You should be able to pick formatting options from a menu and have access to *Microsoft Word*–like style sheets. Also, *1-2-3* should show page layouts on-screen (as did the once-promising Bruce & James *WordVision*) and use the cursor or mouse to adjust margins, page length, and so forth.

Print-range-width counter. *1-2-3*



1-2-3 in 3-D

1-2-3 desperately needs a grown-up way to link multiple spreadsheets. (The /File Copy Combine command lacks sophistication, and you shouldn't be forced to use *HAL*.) Better still: a 3-D feature to roll up multiple spreadsheets into the pages of a single spreadsheet.

should tell you how wide your printout is, so that you know if it fits on a single page. It should also show you where page breaks fall and/or have a conditional page command that tries to break pages on blank rows.

Editable filenames. If you make a mistake entering a filename during a /File Retrieve, *1-2-3* beeps and forces you to start over again. For the sake of internal consistency (and your mental health), you should be able to edit the line using the F2 (Edit) key, as you should for changing the filename during a /File Save.

No copy protection. Lotus, please don't cop out by reciting your half-hearted corporate unprotection plan that works only if you can round up 100 upgrades or 100 purchases at a time and pass a Lotus character check. Copy protection only serves to underscore Lotus's image, deserved or not, as an arrogant company.

"OUGHT-TO-HAVE" FEATURES

Serious graphics. *1-2-3* graphs may be meant as an analytical tool (you convince yourself the data looks right, then you redo it on a serious graphics program to pass around), but the fact remains, *1-2-3* graphs often are used as presentation graphs. This is where *SuperCalc* overpowers *1-2-3*. *Harvard Graphics* and *Freelance Plus* shouldn't be sold as *1-2-3* repair kits.

A toggle between spreadsheet view and a databaselike forms view. In the forms view, all the cells on a single spreadsheet row (that is, the equivalent of a database record) would be arrayed vertically. You should be able to enter data or set the criteria for a data extraction from the forms view.

Seamless auditing. *1-2-3* needs the equivalent of *Spreadsheet Detective* or *The Cambridge Spreadsheet Analyst* built in so that you can trace relationships and hunt down circular references from within *1-2-3*. It should warn you immediately of other probable boners, such as a formula referring to a blank or text cell.

Undo. If you mistakenly overwrite a cell or louse up a formula, you should be able to take it back—without hogging vast amounts of memory the way *HAL* does.

Auto-toggle between 25- and 43-line modes on EGA monitors without exiting *1-2-3* or buying *SeeMORE*. Some EGA-plus cards (Paradise, for example) give you as many as 60 rows on-screen, but you have to stop and then restart *1-2-3* to switch.

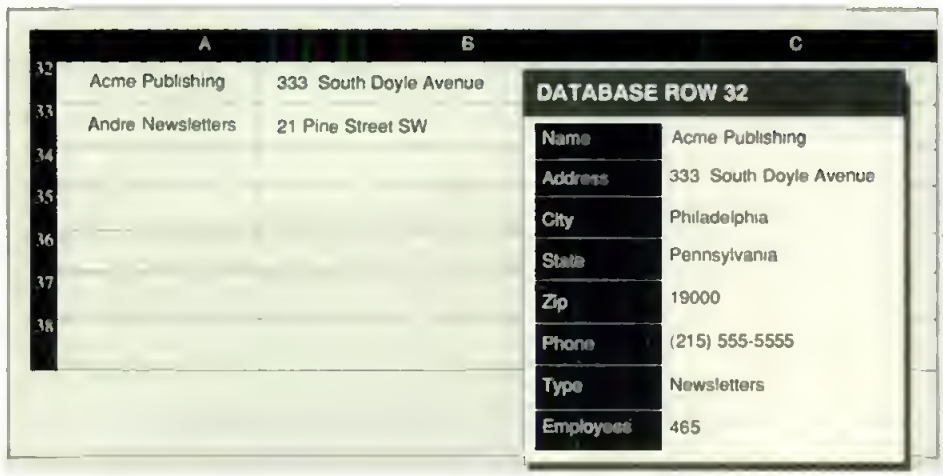
Better use of the function keys. PCs have 40, including Ctrl-, Alt-, and Shift-functions, and *1-2-3* barely puts a half-dozen of them to good use. (Yes, yes, we know *1-2-3* uses ten function keys; we said "puts to good use.")

Nondestructive block moves. If you select cells A10..H15 and move them down to a block beginning at A45, *1-2-3* should give you the option, as *SuperCalc* does, to push down or push over any data that would be overwritten.

Cell annotation. As in *Note-It* or *SmartNotes*. The note box should dynamically expand as your note size expands.

1-2-3 as Database

Only *dBASE III* finds more use as a database. *1-2-3* users should be able to toggle between *1-2-3*'s traditional table view and a database-like forms view (right), in which you see the entire contents of one record on-screen. Currently, only the simplest databases (with records of less than 72 characters) can be seen in their entirety.



And/or you should be able to add a note to the end of the formula, as *Silk* does.

Search (and replace). You should be able to find a phrase, formula, or value without paging through the worksheet manually.

***Silk*-style recovery.** *Silk* saves your keystrokes to disk; if you crash, you can reconstruct your work readily.

Navigational aid I. A minimap of the worksheet ranges (on a graphics monitor) represented by varying-color blocks with range names superimposed. To move to a range, you'd move your cursor or mouse there and hit Enter.

Navigational aid II. *1-2-3* needs a return-to-the-previous-cell command, especially useful if you're deep in the spreadsheet and graze the Home key. Also desirable: a command to take you to the beginning of the next line; a variation on End-Home that takes you to the end of the data, not beyond (which happens if your last data cell is R55 but you formatted blank cells out to Z80), and another that takes you to the extremities of the current range.

Intelligent dates and date data fill. *1-2-3* should be smart enough to fill ranges as *Javelin* does, knowing that Jan is followed by Feb and Mar, that Q1 88 precedes Q2 88, and so forth, and it should follow your style: for example, "Feb," "February," "Feb-88," "2/88," and so on. In date-formatted ranges, *1-2-3* shouldn't require so many keystrokes; it should intuitively know that "2 88," "2/88," and "Feb 88" all mean February 1988, either (your choice) the first day, the last day, or any day within the month. *1-2-3* should know that "12" means the 12th of the current month, and *1-2-3* should have a way to understand the last day of the month, whether that date is 28, 30, or 31, as well as the last Friday of the month or the last weekday of the month. *1-2-3* should know about the major holidays (Thanksgiving, Fourth of July), and you should be able to spoon-feed it quasi-holidays (the Friday after Thanksgiving) or regional holidays (Patriot's Day in Massachusetts, Martin Luther King Day everywhere but in Arizona), so that you can calculate working business days.

> Software should be seen and not heard. Let users turn the error beep off.

Screen colors. You should be able to pick any foreground/background combination; also, to use color to indicate negative numbers, numbers above or below a certain limit, numbers that changed with the last recalc, cells to be filled in by an associate, cells associated with a specific range, cell dependencies, or annotated cells.

Cell description window. If you have /Worksheet Titles turned off, you should have a tiny window that shows the label at the top of the column you're currently working in and the label at the left edge of the row you're working in. For example, you're in cell K99. Cell K1 reads Boston; cell A99 reads "Foreclosures"; the description window would read "Boston Foreclosures." Going one step further, even if you haven't formally made it a named range, *1-2-3* should know if you type Boston Foreclosures in a formula that you mean cell K99.

Smarter @NA function. You should be able to sum or average a group of numbers containing an @NA for a trial total, just as you would with a calculator. You'd ignore the not-available cell. If you have 5, 10, 15, 20, and @NA, the sum would be 50 and the average would be 12.5. The tentative result would be in a special color or highlighted so that you know you still have work to do—or *1-2-3* could add an @NYA function, Y for yet.

Better reports. *1-2-3 Report Writer* should be another facet of *1-2-3*, not a $95 add-on. Ditto for *HAL* ($150).

"NICE-TO-HAVE" FEATURES

Macros stored outside the worksheet (so that you can work on more than one worksheet at a time). As well as inside. Your choice.

Intelligent printed-page borders. If you tell *1-2-3* to print the top row of the worksheet at the top of each printed page, using the Borders command, you should have an except-on-page-1 option so that you don't get it printed twice.

Support for proportional printer fonts and big type fonts. You should at least get proportional text and ought to be able to print number cells proportionally by aligning on the decimal points.

Variable row heights. Often, the labels at the tops of columns are far longer

Cell Description Window

Deep in the bowels of a spreadsheet, you may forget what a cell's contents mean unless you have the Titles option on. Alternatively, a locator window would list the leftmost cell of your current row and the topmost cell of your current column.

32	834	756	455	511	622	455	756	834	756	511	834	622	455
33	546	765	503	523	631	503	765	546	765	523	546	631	503
34	654	768	523	521	634	523	768	654	768	521	654	634	523
35	765	788	521	528	635	521	788	765	788	528	765	635	521
36	426	798	499	536	630	499	798	426	798	536	426	630	499
37	679	823	476	548	607	476	823	879	823	548	879	607	476
38	287	834	434	555	576	434	634	267	834	555	287	576	434

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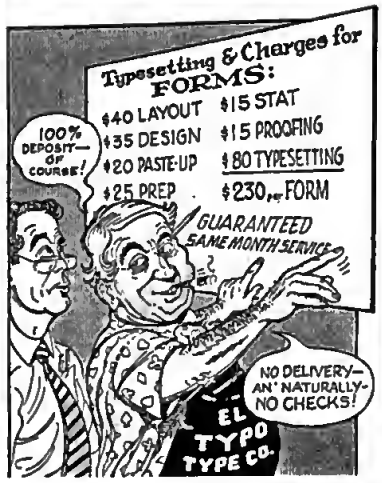

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■ WISH LIST

than the numbers underneath, so you need to use two, three, or four rows to write your label. The row height should dynamically expand with the size of your longest label, and text would wrap within each cell. If your column width later changed because you were plugging in bigger numbers, a text label that formerly needed four lines might drop to three.

Telecommunicable *1-2-3* files (perhaps saved as FILENAME.SND) that work with any comm program over any packet-switching network. *1-2-3* uses high-order characters, so if your program or data carrier doesn't support 8-bit data transfer, you're sunk. Since Lotus is trying to push *Express*, which can send unmodified *1-2-3* files, this is unlikely ever to see the light of day.

Responsive default screens. When you call the /Worksheet Status or /Worksheet Global Default Status screens, if you don't like one of the settings, you should be able to change them right there.

Expanded-memory kill switch. If you have an EMS board, Lotus uses it whether the lower 640K is full or not. EMS memory is markedly slower than conventional RAM, so you should be able to turn EMS off from within *1-2-3*.

No-beep option. Software, like children, should be seen and not heard. Let users turn the error beep off, or be given the option to reduce the intensity and duration.

Clear error messages. Beep or no beep, Lotus should explain what you did wrong, and, if it knows, position the cursor at the mistake. All too many software authors are painfully oblivious to the obvious: if you make a mistake, you're going to have to fix it.

Formatting by column or row. You should be able to format ranges by column or by row, so that if the data expands, the formatted range expands, too. Otherwise, if you overformat a range for expected numbers that never come, an End-Home takes you beyond the end of your worksheet.

Global and range round-off. Fractional results ($99.95 + 6.25% sales tax) can throw off a calculation, but it's such a pain to format each cell with @ROUND (formula,2). Better you should have that as a global or range option.

Protect the first file. If you /File Save an unnamed worksheet and hit Enter, *1-2-3* tries to overwrite the first in (ASCII) order of your on-disk worksheets. Smart *1-2-3* users have a blank 0.WK1 file for just that eventuality. But you shouldn't have to stick Band-Aids on a program that has a 90-plus percent market share.

Graceful exits. When you quit, erase a worksheet from the screen, or call another file, *1-2-3* should warn you that you're about to zap data that's changed since you last (or ever) wrote it to disk. The current "are you sure? Y/N" warning doesn't know if you have unsaved data at risk.

Bring back the @TODAY function. Sometimes you want accuracy only to the day, not to the second. Actually, it never went away—*1-2-3* just turns @TODAY into @NOW. If you wanted @NOW, you would have typed @NOW.

NOT IMPRESSED We agreed up front that Lotus's three painfully obvious responses to our carping hold no water:

- "You can do it with a macro." You shouldn't have to do it with a macro.
- "You can do it with *HAL*." *HAL* is nice, but *HAL* isn't a panacea. Some contrarians believe *HAL* is vastly overrated.
- "There are third-party products available to do that." Pul-lease. *1-2-3* should not be misconstrued as The Small Software Developers' Full Employment Act.

One parting shot: If *1-2-3* does even half the things listed above, the program will be too heavy to fly. So you should be able to toggle features in or out of the program (much as word processors allow you the option of loading a dictionary file into memory), depending on how much memory you have. Lotus will say, "Buy an expanded memory board." We say, "Give us a break. And give the user the option to tweak the program for maximum worksheet size or for maximum features loaded into RAM. *SuperCalc* does."

If all of these possibilities for *1-2-3* seem like a quantum leap, just imagine what Lotus could accomplish with its graphical version destined for OS/2 machines, *1-2-3/G*. PC

Bill Howard is an executive editor of PC Magazine. *Jim Seymour is a contributing editor of* PC Magazine. *Jared Taylor is the West Coast editor of* PC Magazine.

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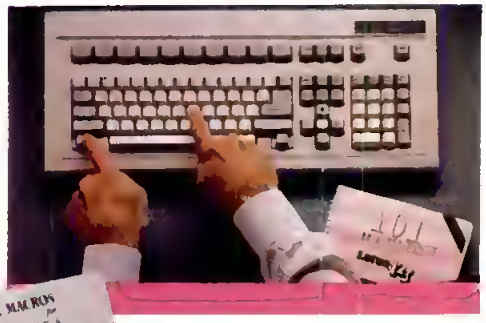

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CIRCLE 135 ON READER SERVICE CARD

On the Road Again:

THREE NEW LAPTOPS JOIN THE RACE

Nearly 2 years have passed since Toshiba introduced the first of the modern clam-shell-design laptop PCs with a flip-up screen and disk storage, the original T1100, touching off the rush to DOS-to-travel that will account for roughly one of every ten MS-DOS machines sold this year.

Recent products in the laptop portables arena come from companies still trying to get the formula right (IBM on its third go-round with the PC Convertible), companies that already build bigger lunchbox- and sewing-machine-size portables (Sharp, Datavue), companies that built non-DOS laptops and decided to go mainstream (Tandy), and companies expanding their product lines with smaller, cheaper, or faster units (Toshiba, Datavue).

Datavue and Tandy have introduced new competitors to the crowded laptop market, and IBM has released the third incarnation of its PC Convertible. Can any of these new arrivals outstrip the leaders of the pack?

Unlike last year, a majority of the new machines now have backlit LCD screens standard or as an option, following the lead of Zenith, which put a dazzling display on an otherwise ordinary laptop PC and leapt toward the top of the sales charts. Illuminating the screen halves battery life, but most users find they're unlikely to be in need of more than 2–3 hours of computing away from an AC power source.

Long-term laptop users find their needs change. If you travel frequently by plane and carry the laptop long distances through airports, or if you're a public transportation commuter, you learn to hate excess weight and bulk. Conversely, if you have

to lug the machine only a few steps from your office to the parking lot, you may find the trimmest laptop lacks the speed, disk capacity, or readability you really need. That's especially so if your company makes your laptop double as your desktop machine.

In this issue, *PC Magazine* reviews laptops from three makers:

■ The IBM PC Convertible Model 3, with a backlit display and a hefty price cut.

■ The Tandy 1400 LT, a beefy but affordable ($1,599) DOS-to-travel entry from a company famous for its note-taking Models 100/102/200 and infamous for its clunky, DOS-like, DOS-incompatible Model 600 (hint: no matter how cheap Tandy discounts the Model 600 leftovers, don't be tempted).

■ Datavue's unique Snap 1+1, which separates the disk drive pack from the main keyboard/display/memory module.

Other companies have announced but not yet shipped product. They'll be reviewed in future issues:

■ Toshiba's 6½-pound, one-drive T1000 and the T1200, a 20-megabyte variant of the best-selling T1100 Plus. Toshiba's ship dates stalled in the aftermath of the ill will generated by its submarine-propeller deal with the Russians that could lead to Toshiba's temporary exile from the U.S., and the administration's 100 percent tariff on Japanese 16-bit laptop PCs. Prices haven't been set, yet.

■ Sharp's PC-4501 and PC-4502 laptops, bare-bones one-drive and backlit two-drive units, tentatively priced at $1,295 and $1,695, respectively, for 256K units, with hard-disk versions hinted.

STILL TO COME What's over the horizon? You're certain to see refinements to the displays, more hard drive options, 1.44-megabyte floppy drives matching the capacity of IBM's PS/2 line, slightly more RAM with the excess above 640K devoted to a RAMdisk or EMS memory, cheaper accessories ($200 rather than $400 modems), and some 80286-based units without today's $4,000 price tags. You'll also see more units made in America (actually, assembled in America from Asian parts) because of the laptop tariff.

At the higher end, 80386-based portables are due soon. Typically, they'll be

Laptop Computers: Summary of Features

(Products listed in ascending price order)

	Tandy 1400 LT Tandy Corp.	IBM PC Convertible Model 3 IBM Corp.	Datavue Snap 1+1 Datavue Corp.
Base price	$1,599	$1,695	$2,095
MEASUREMENTS			
Dimensions (HWD in inches)	3.5 × 12.4 × 14.5	2.7 × 12.8 × 14.7	2.8 × 12 × 12.8
Weight (lbs.)	13.5	12.67	12.04 (fully configured)
No. of keys	76	78	83
Handle	●	●	●
SCREEN			
Dimensions (HW in inches)	4.25 × 9.5	3.75 × 10.25	4.5 × 9.5
Type	Backlit supertwist LCD	Backlit supertwist LCD	Supertwist LCD (backlit or gaslit optional)
CONFIGURATION			
Minimum RAM	768K	256K	640K
Maximum RAM	768K	640K	1 Mbyte
Standard disk drives	2 3½-inch floppy disk drives	2 3½-inch floppy disk drives	2 3½-inch floppy disk drives
Microprocessor	NEC V-20	80C88	80C88
Math coprocessor	8087 (optional)	8087 (optional)	8087 or 720191 (optional)
Speed (MHz)	4.77 or 7.16	4.77	4.77
Expansion slots	1 proprietary	1 proprietary	3 half-length
Expansion chassis available	○	●	○
Type of monitor port	RGB, composite	Proprietary	RGB, composite
Serial port	●	●	●
Parallel port	●	○	●
Battery operated	●	●	●
Claimed battery discharge time (hours)	4–8	6–8	6
Battery charge time (hours)	8	8	8
120/240V power supply	○	●	○
STANDARD SOFTWARE			
Disk-based	GW-BASIC, DOS	Editor, communications	DOS
ROM-based	None	None	Configuration, utilities
DOS version supplied	3.2	None (3.3 optional)	2.11
Runs PC-DOS 3.2	●	●	●
OPTIONS			
Hard disk drives	○	○	● (20-Mbyte hard disk disk, $1,400)
Floppy disk drives	○	● (3½-inch, $170)	● (external 5¼-inch, $495)
Car battery adapter	○	● ($25)	○
Carry case	● ($39.95)	● ($44 or $84)	● ($75)
Modem	● ($199.95)	● ($225.00)	● ($325.00)

●—Yes ○—No

AC-only machines for power users on the go. There's also a small but crucial niche for powerful portable demo machines, and anyone who runs a demo wants it to run quickly to make the software look better. Typically, those vendors now use Toshiba T3100s or Compaq Portable IIIs, and the buyers are desperate for on-board support of outboard EGA (and shortly, VGA) monitors, because even if you don't carry an EGA monitor with you, there's likely to be one where you give the demo.

Laptops have become an accepted part of the business scene, and the 3½-inch drives that seemed such an oddity 2 years ago now have support in the new desktop PCs from a growing list that starts with IBM and Tandy.

As you read the reviews below, keep in mind, as our reviewers did, *PC Magazine*'s trio of laptops to beat: The Toshiba T1100 Plus (best all-around combination of small size and power), the Zenith Z-181 and Z-183 (best display), and the NEC MultiSpeed (best performance from a non-286 laptop). See *PC Magazine*'s reviews in Volume 6 Number 13 ("Road Warriors: 11 Laptops Battle It Out") and Volume 5 Number 22 ("DOS Travels Better Now: What's New in Portables"), as well as a roundup of laptop accessories in Volume 6 Number 16 ("Laptop Add-ons for Desktop Power").—**Bill Howard**

The Datavue Snap 1+1 is the first fully component-based laptop computer. It is pictured here with the standard supertwist LCD screen. Also available and easily interchangeable are a backlit display ($400) and an amber gaslit display ($500).

DATAVUE CORP.

Datavue Snap 1+1

When *PC Magazine*'s editors brainstormed to design the perfect laptop, they came up with a lightweight, diskless screen/keyboard base unit to which floppy drives or a hard disk could be attached.

With the Snap 1+1, Datavue has brought this vision to life, creating the first mix-and-match laptop. But while the machine has some innovative design features to its credit, reality is much more expensive than fantasy.

Designed to be sold in pieces, the Snap is no bargain by the time you get it configured. The $1,095 base unit, called the Lapheld module, has a 4.77-MHz 80C88 processor and an 83-key keyboard, but no display. Up to 360K of RAM on the optional $795 ROM/RAM memory card can be used as a RAM drive to make the 4-pound, 3- by 12½- by 7½-inch (HWD) unit viable as a notebook machine.

For another $1,000 you also get a supertwist display and the back half of the laptop, a separate chunk holding two floppy disk drives and a full 640K RAM. Another $1,400 will buy an expansion unit containing one floppy drive and a 20-Mbyte hard disk. If you want to put what you're doing in a better light, two optional displays are available: a backlit electroluminescent display for an additional $400, or an amber gaslit display for $500. A Hayes-compatible, 300/1,200-bit-per-second modem with Crosstalk communications software is $325. Each of the Snap's component parts can be bought separately.

But does this laptop really "snap" together? Not exactly, but if it did I don't think I'd trust it. In order to separate the front and back components, you need about one minute and a dime. Four attachment points, two on each side, must be unscrewed. Fortunately, the screws stay in their housings when they are loosened so that there are no tiny parts to lose. The dime will also come in handy to pry open the doors that hide the parallel, serial, video, and modem ports. Another door in the rear of the disk drive module hides a half-card expansion slot.

The vital piece in this puzzle is the $795 512K-byte CMOS ROM/RAM memory card that slips into the back of the Lapheld module. With this card's 360K RAM disk and the battery boost the card provides, the diskless chunk should serve most user's needs on the road for up to 6 hours. If you think you can stand working without disk drives this 4-pound burden will be a very

FACT FILE

Datavue Snap 1+1
Datavue Corp.
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(404) 564-5668
List Price: Lapheld module, $1,095; with dual floppy expansion unit including 640K RAM and supertwist LCD screen, $2,095; with expansion unit with one floppy disk drive and 20-Mbyte hard disk, $3,495; RAM/ROM memory card, $795; backlit display, $400; amber gaslit display, $500; external 5¼-inch disk drive, $495, 300/1,200-bps modem, $325; carry case, $75.
In Short: An interesting but expensive component-style laptop that can be used as a diskless notebook machine or as a fully configured 20-Mbyte hard disk laptop.
CIRCLE 675 ON READER SERVICE CARD

Photographs: Roberto Brosan

easy one to bear when you travel with it.

The nickel-cadmium battery, located in the expansion module, can power the entire computer for up to 6 hours. Both this battery and the supplemental battery on the ROM/RAM memory card are recharged when the AC adapter is attached. The hard disk module runs on AC power only.

KEYBOARD DESIGN The 83-key keyboard is one of the best yet on a laptop. The only truly misplaced key is the Backspace key, which sits high above the enlarged Enter key on the upper right-hand corner. A separate numeric cursor pad also resides awkwardly in the upper right-hand corner. Keyboard feel is excellent, with a firm click that nicely emulates the response of IBM's desktop keyboards. A Crtl-Shift-Plus key combination activates an adjustable beep for typists who like confirmation of their keystrokes.

Other Crtl-Shift key combinations call up setup procedures, help screens, and a world clock of dubious value.

Our evaluation unit came with both a supertwist LCD screen and an amber gaslit display. The big surprise is that the LCD screen, with its white-on-blue (or inverse) display, is far easier on the eyes than the smudgy yellow-on-orange of the gaslit display. Like everything else about the Snap, screens are easily interchangeable; in fact, the screen is the one component of this system that literally snaps into place.

In benchmark testing, the Snap performs slightly off the pace of an IBM PC-XT. The hard disk, definitely no speed demon, has a tested access time of 79.37 milliseconds.

At slightly over 12 pounds when fully configured, the Snap is on a par with most of its competition, perhaps a bit better considering that weight can include a 20-megabyte hard disk. It has a handle, and an optional carrying case is available.

Datavue's documentation suggests that the possible permutations of Snap configurations are endless. The company even describes the kind of setup where several employees head out into the field with diskless modules and then come back to a common hard disk module to process their data.

It's an interesting concept, but when you consider that even a diskless module (with the RAM card) will cost almost $2,200, you might want to buy everyone a NEC MultiSpeed or Toshiba T1100 Plus instead and be done with it. At $3,790 for a fully configured, top-of-the-line Snap, versatility is a luxury indeed.

—Donald P. Willmott

IBM CORP.

IBM PC Convertible Model 3

IBM's third try with the PC Convertible puts IBM where it should have been a year and a half ago. At $1,695, the backlit Convertible Model 3 brings a fair mixture of features and price to the growing DOS-to-travel market.

If you haven't yet bought a laptop portable and you aren't looking for maximum speed or minimum size, the Convertible should be on your finalist's list. While it may not survive the last cut, no longer is the PC Convertible just the clunky box with the famous name.

To pique your interest, IBM offers features such as:

- a dazzling blue-on-white backlit screen,
- the best keyboard feel of any portable,
- front-facing dual 720K-byte floppy drives,
- battery life that is better than the competition, and
- a marvelous, IBM-exclusive instant-resume feature that lets you kill the power in the middle of a program and then restart the app later without losing a bit of data.

The downside for the PC Convertible is still a bit dismal: the nearly 13-pound box is too big and it only gets bigger, because the parallel/serial and video ports that everyone else makes standard come as a pair of extra-cost, space-hogging clip-on modules; only 256K of RAM is standard in the $1,695 base price; the power brick takes up as much space as two 20-disk stacks of microfloppies; the screen doesn't tilt back as far as you'd like; half the cursor-control keys are missing; the function keys are half-size; and the leisurely 4.77-MHz 80C88 processor belongs in a museum, not a computer.

BIG BRIGHT BLUE Zenith set the standard for laptop displays in 1986 with the Z-181's huge (by laptop standards) 8- by 6-inch backlit screen and a PC standard 1.33-to-1 aspect ratio. Revision 3 of the PC Convertible has a similarly brilliant display, also a deep blue on an off-white background, that lacks Zenith's visual impact because the IBM screen is about 10½ by 3½ inches, yielding a quarter less viewing area and a gawky 3-to-1 aspect ratio. On an IBM screen, a drawing of Wilt Chamberlain would come out looking like Willie Shoemaker, proving ownership has its disadvantages.

If you want to save $300, a nonilluminated, supertwist LCD screen is available as the PC Convertible Model 2, base priced at $1,395 (256K) and $1,900 (640K). It's about on a par with the Toshiba T1100

DOS TO TRAVEL—IN STYLE

As a kid, did you ever get a Christmas present that came in a huge cardboard box and find that the box was more fun to play with than the present? You might encounter déjà vu if you pick up an IBM PC Convertible Model 3 and its optional carrying case.

The $44 padded PC Convertible carry case is a marvel of price and utility, a more perfect device than the PC Convertible. It's cheap and chock-full of compartments, including a 13-inch-square accessories pouch that expands kangaroo-style from zero to 3 inches deep. That's handy because when you travel, your laptop accompanies rather than supplants your briefcase. With IBM's bag, you could leave your briefcase at home. Having fewer bags in hand is always better on trips, especially when you have to navigate the aisles of an airplane with your overnight bag in the other hand. Does any sane traveler still risk his luggage to the cargo hold?

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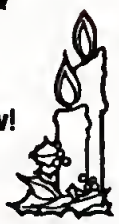

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IBM's PC Convertible Model 3 draws your eyes to its vastly improved, blue-and-white backlit display. Machines without the new display are available for $300 less than the $1,695 retail price of the new model, but the investment is definitely worth it.

Plus, which is to say quite acceptable—for nonilluminated displays. You should expect 2½ times the battery life with the nonilluminated Convertible Model 2. IBM rates them at 4 and 10 hours.

Nonilluminated PC Convertibles can be upgraded with a do-it-yourself $350 kit comprising a beefier 16-watt power supply, up from 12 watts, and the backlit screen. It works with the original nonbacklit, non-supertwist-LCD Convertible (which retroactively became the Model 1) as well. You can also upgrade your original Convertible to the better nonilluminated supertwist LCD screen for $225.

INSTANT RESTART Every serious DOS laptop, save IBM's, works like a desktop machine. When you kill the power, you lose everything in memory. If the boarding agent announces final call for your plane and you hit the power button and run, you stand to lose everything since your last disk save. And even if you do save to disk, restarting remains a hassle because a generation of power users bred on fast hard disks quickly become impatient waiting for bog-slow 3½-inch microfloppy machines to grind through their power-on tests, then load DOS, the applications program, and finally the data—sometimes 2 to 3 minutes.

Because IBM uses static RAM, rather than the cheaper dynamic RAM, you can configure the Convertible to resume where you left off when you powered down—same program, same data file, same cursor position. The startup sequence takes about 10 seconds. PC Convertible users will quickly become spoiled by this feature, as well they should, and wonder why the Toshibas and NECs of the world don't catch on. IBM neglected to give the feature a catchy name (something like Jackrabbit or Quick-Draw) beyond simply "resume," but it stands as Big Blue's major contribution to portable computing. The static RAM doesn't come cheap, costing about twice as much as dynamic RAM. Add in IBM's overhead and you arrive, reasonably, at the $345 and $160 prices for the 256K and 128K upgrades.

ABOUT TIME Since the machine's introduction in April 1986, IBM has made a series of steady improvements (in IBM's eye) to the PC Convertible with the intent of catching up with the competition. Maximum memory is now 640K rather than 512K (it's laughable that one of the biggest laptop boxes initially didn't have room for that final 128K), the PC Convertible's modem now offers the Hayes command set as well as the IBM Control-N command set (we never heard of it, either), and prices are lower.

The PC Convertible comes with AppSel and SysApps, a combination of a DOS shell, a function-key-driven application selector, and *SideKick*-like pop-up system applications: a six-page notepad emulating *DisplayWrite*, a scheduler, phone book/dialer, and calculator. They're nice but they work only on the Convertible, so you can't have a consistent set of utilities on both desktop and laptop machines.

SHOULD YOU BUY? The PC Convertible has made great strides since its introduction and it's no longer a slow, overpriced, overlarge, hard-to-read laptop with a famous pedigree. Now it's just too big, too slow, and a bit too costly. Properly equipped with the modem, DOS, printer and COM ports, and a carrying case, you're looking at $2,669 before you start talking discount. If that's damning with faint praise, that's because the competition has gotten better, too.

The things IBM does well, it does better than anyone else. The keyboard, despite the absence of directly accessible Home-End-PgDn-PgUp keys, is a typist's delight. And the instant-resume feature will grow on you. There are nice little features such as a power supply that automatically adapts to European voltage. And construction quality is IBM solid. You shouldn't be embarrassed buying the Convertible.—**Bill Howard**

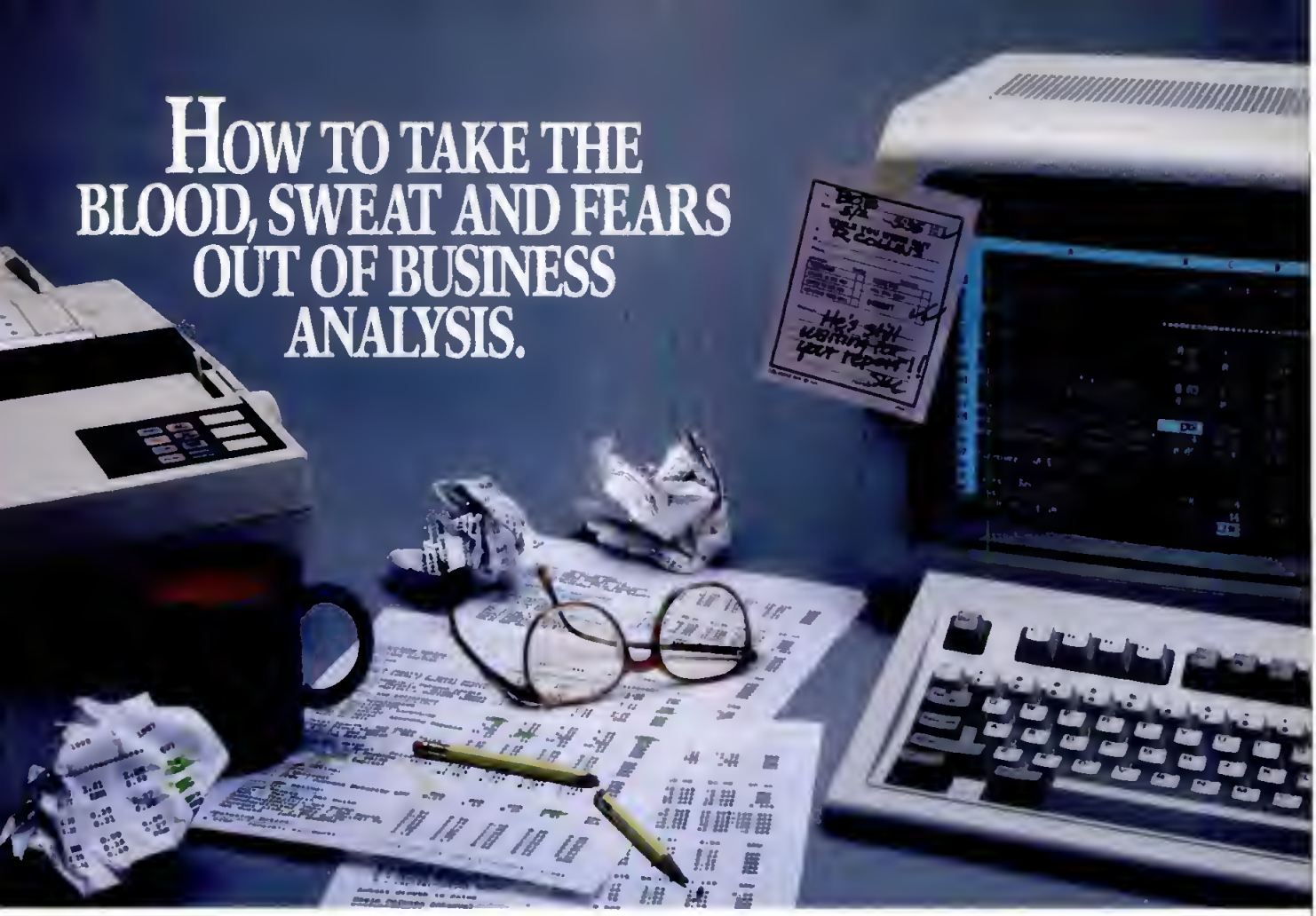
PC MAGAZINE

FACT FILE

IBM PC Convertible Model 3
IBM Corp.
Consult your local authorized dealer
List Price: $1,695; Model 2 with supertwist LCD screen, $1,395; screen upgrade for Model 2 owners, $350; 1,200-bps internal modem, $225; 256K memory expansion card, $345; 128K memory expansion card, $160; serial/parallel adapter, $80; DOS 3.3, $120; carrying case, $44 or $84 (larger size).
In Short: The new backlit supertwist LCD display is a major improvement to the PC Convertible, and the $1,695 price is competitive, but it's still too slow, too big, and too heavy.

CIRCLE 674 ON READER SERVICE CARD

How to take the blood, sweat and fears out of business analysis.



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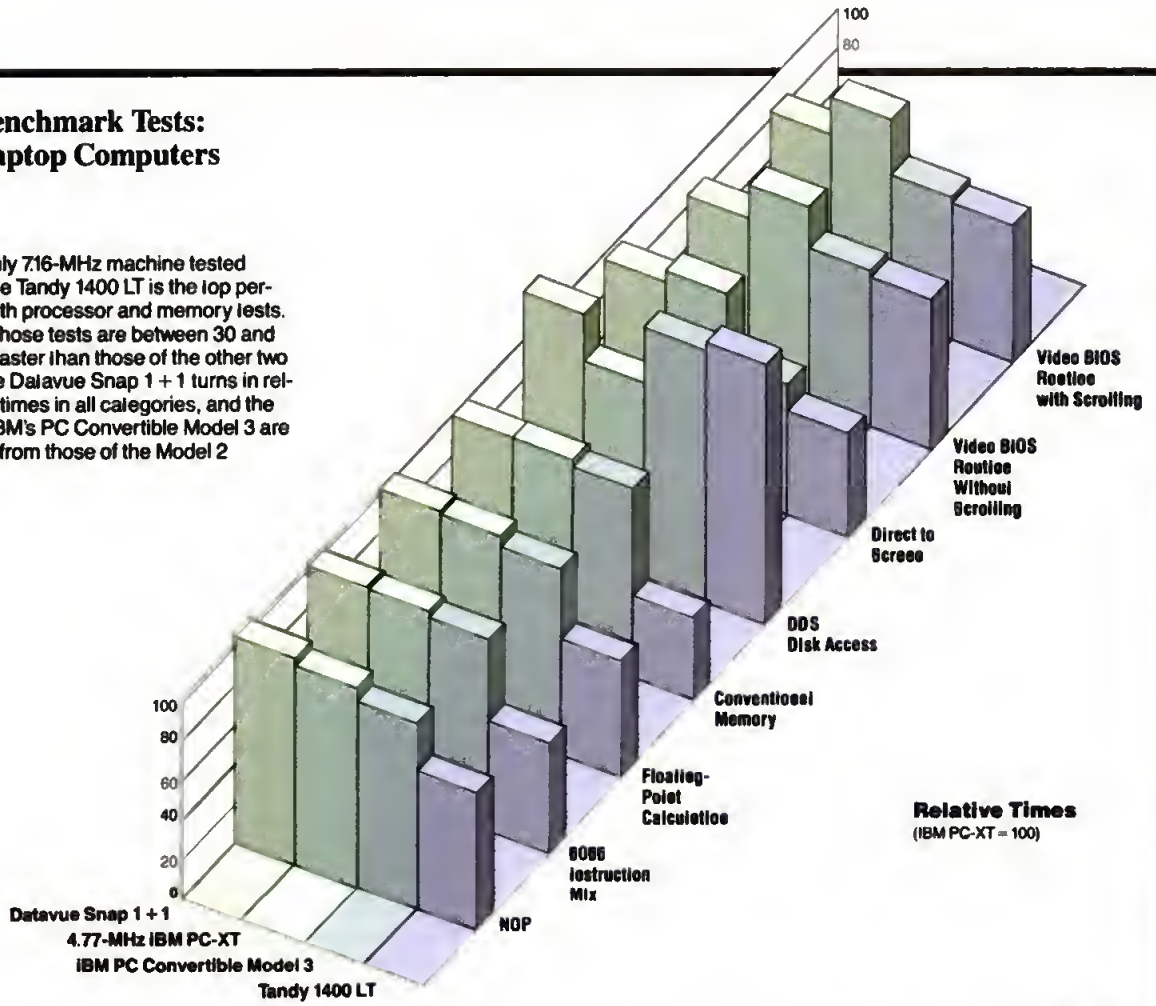
CIRCLE 268 ON READER SERVICE CARD

Benchmark Tests: Laptop Computers

As the only 7.16-MHz machine tested here, the Tandy 1400 LT is the top performer in both processor and memory tests. Its times in those tests are between 30 and 60 percent faster than those of the other two laptops. The Datavue Snap 1 + 1 turns in relatively slow times in all categories, and the results for IBM's PC Convertible Model 3 are unchanged from those of the Model 2 version.



Performance Times
(Times given in seconds except where noted)

	NOP	8086 Instruction Mix	Floating-Point Calculation	Conventional Memory	DOS Disk Access (milliseconds)	Direct to Screen	Video BIOS Routine Without Scrolling	Video BIOS Routine with Scrolling
Datavue Snap 1 + 1 (4.77 MHz)	10.49	32.41	161.75	5.91	299.01	11.04	14.45	19.11
4.77-MHz IBM PC-XT (360K floppy disk drive)	10.10	32.00	159.20	5.90	242.30	11.60	17.30	23.30
IBM PC Convertible Model 3 (4.77 MHz)	9.40	31.00	150.50	5.70	308.10	7.60	13.60	16.80
Tandy 1400 LT (7.16 MHz)	7.00	18.00	94.00	2.50	317.00	6.00	13.00	16.00

The **NOP** benchmark test is designed to measure raw clock speed and memory access time while minimizing differences in microprocessors and the effect of memory caching. This test executes almost nothing but NOP ("No Operation") machine code instructions in a big 128K loop.

The **8086 Instruction Mix** benchmark test measures the time it takes to execute a selected series of processor-intensive tasks. The test program uses 8086 instruction code. These instructions are a subset of the total processor instruction set.

The **Floating-Point Calculation** benchmark test measures processor speed by looping through a series of floating-point calculations, including multiplication, division, exponentiation, and logarithmic and trigonometric functions. The benchmark program uses the floating-point library included with Microsoft C Compiler 4.0.

The **Conventional Memory** benchmark test allocates 256K bytes of conventional memory and treats it as a series of 64-byte records. Then, 16,384 random records are read into and written from this memory. The result shown is the average of the read and write times.

The **DOS Disk Access** benchmark test measures the time it takes to do a random sector read using DOS. DOS buffers are set at 3, and the interleave factor is left at the drive's default setting. This test adds DOS's overhead to the BIOS and hardware times. The test program performs the sector read 1,000 times within the DOS disk partition. The average result is shown in milliseconds.

The **Direct to Screen** benchmark test measures the bandwidth of the video adapter by writing directly to the display memory buffer. The test is performed in video mode 3. The entire screen is updated using the assembly language REP STOSW instruction with register CX equal to 2000. This is done 1,000 times.

The **Video BIOS Routine Without Scrolling** benchmark test measures the speed of the BIOS Teletype routine without scrolling. The test is performed in video mode 3. The screen is cleared and 24 lines of 80 characters each (including a terminating carriage return and line feed) are written to the display through the BIOS Teletype routine. This is done ten times. The result shown is the total of the ten trials.

The **Video BIOS Routine with Scrolling** benchmark test measures the speed of the BIOS Teletype routine with scrolling. The test is performed in video mode 3. The screen is cleared and 240 lines of 80 characters each (including a terminating carriage return and line feed) are written to the display through the BIOS Teletype routine. Although the first 24 lines written to the display do not involve scrolling, all the remaining lines scroll the display.

TANDY CORP.

Tandy 1400 LT

In a way, it was Tandy that started the whole laptop craze. Long before Toshiba, Zenith, and NEC became laptop names, the tap-tap-tap of Model 100 keyboards kept time in press conferences, interviews, or wherever reporters were to be found.

The Model 100 was a marvel in its time, but it's no competition for today's powerful little DOS machines with their big displays and storage capacities and fast processing. So Tandy is catching up with other portable makers by introducing a DOS laptop of its own—the Tandy 1400 LT.

The $1,599 LT has a backlit supertwist LCD screen, 4.77/7.16-MHz NEC V-20 microprocessor, 640K bytes of RAM plus a 128K RAM disk, and two 3½-inch floppy disk drives.

At 13½ pounds, the LT weighs more than the Toshiba T1100 Plus and the NEC MultiSpeed, and it's bulkier than most of its peers. Sit a T1100 Plus on top of the LT, for example, and you'll see inches of Tandy hardware sticking out under the Toshiba machine. It's also higher than other laptops; the black plastic bottom minimizes the machine's height, but it can't disguise its 3½-inch height—taller than every other laptop except the Wang. The handle that folds out from under the front of the machine makes it easy to carry, as does the carry case ($39.95).

The LT has a well-appointed keyboard with large shift and enter keys, 12 small function keys arranged along the top, and cursor movement keys clustered in the lower right corner. There's no separate numeric keypad. Five LEDs above the function keys tell you what's going on with the LT. CapsLock, NumLock, and ScrollLock are assigned red lights, as is the low-battery indicator. A green "standby" LED is illuminated when a disk drive is accessed. Keyboard feel could be firmer, but it's about what you expect from a laptop.

FLEXIBLE LID The double-hinged lid that holds the screen can be folded back flat onto the computer—an ability that isn't all that important to me, but one that evokes praise from many. The light-blue backlit screen is clear and legible, but it is plagued by a constant shimmer. When we pointed out the problem on a prototype a few months ago, Tandy engineers said it would be fixed by the time the machine came to market. The models we saw on introduction day were still flickering away—a disappointing and annoying glitch in an otherwise good display.

Priced at $1,599, the new Tandy 1400 LT, shown here running Tandy's DeskMate *software, is positioned to make an impact on a large slice of the laptop market. Standard equipment includes the backlit display and two 3½-inch microfloppy disk drives.*

Processing speed never used to be a real issue with portables, but as desktop machines approach 20 on the megahertz scale, everyone wants fast laptops too. The NEC V-20 inside the LT lets it clip along at 7.16 MHz—not as fast as the V-30-equipped NEC MultiSpeed, but equal to most of the other machines in its class and faster than both the IBM PC Convertible Model 3 and the Datavue Snap 1+1.

Standard addressable RAM is 640K bytes; the 128K RAM disk boosts the total to 720K.

Batteries are handled elegantly in the 1400 LT: a 12-volt rechargeable battery covered in yellow rubber resides in a chamber on the left side of the machine. A sliding panel on the top of the laptop opens easily so you can lift out the battery and put in a recharged one. Battery life is rated at 4 hours. Of course, the LT will also run off AC power using the adapter that comes with the machine.

Interfaces include the standard 9-pin serial port, 25-pin parallel printer connector, and 9-pin CGA output. There's also a connector for an external disk drive and one for a regular 101-key keyboard. Tandy suggests you can plug a big keyboard and a full-size monitor into your LT and have a full system. Since you're unlikely to own a full-size keyboard and a standard monitor without having a desktop computer, this seems a little silly, not to mention awkward. But I suppose if your desktop ma-

FACT FILE

Tandy 1400 LT
Tandy Corp.
1700 One Tandy Center
Fort Worth, TX 76102
(817) 390-3700
List Price: $1,599; 1,200-bps modem, $199.95; spare battery pack, $79.95; 8087 math coprocessor, $399.95.
In Short: A reasonably priced laptop with a good keyboard and screen. A bit zaftig, but if price and performance are more important than compactness, the LT is a good choice

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■ LAPTOPS

PC MAGAZINE EDITOR'S CHOICE

Reviewing groups of laptops always brings out the Dr. Frankenstein in us. If we could take the potential functionality of the Datavue Snap 1+1, graft on the keyboard and screen from the IBM PC Convertible Model 3, and generate the 7.16-MHz heartbeat of the Tandy 1400 LT, we'd have a monster to contend with.

For now, we'll look back to the Editor's Choices selected in "Road Warriors: 11 Laptops Battle it Out" (Volume 6 Number 13) and suggest that you consider the $1,995 NEC MultiSpeed (with its new backlit screen), the compact $2,099 Toshiba T1100 Plus, and for big spenders, the dazzling Zenith Z-181 or Z-183 Portable PC. $3,399 is a lot of money to invest in a laptop, but with its 10-megabyte hard disk, 8-MHz clock speed, and remarkable 6- by 8-inch backlit display, the Z-183 remains a heart-stopper.

chine uses 5¼-inch disks and you don't want to transfer data . . .oh, well, I'm sure there's a good reason there somewhere.

If the LT is only average in compactness and features, it transcends mediocrity in the area of price/performance. At $1,599, it's cheaper than everything except the minimalist Datavue Spark and the uncompetitive Bondwell 8. High-end power users who demand hard disks and extended memory support will opt for a jazzier machine, but for regular on-the-road use, you could do a lot worse than the 1400 LT. And as always, there's the reassuring presence of Radio Shack service. With a Tandy machine, it doesn't really matter if you live in New York, Nantucket, or Nome. Throw it into the subway, rowboat, or dogsled and head to your nearest Radio Shack store.—**Nora Georgas**

Bill Howard is an executive editor of PC Magazine. *Nora Georgas is an associate editor of* PC Magazine. *Donald P. Willmott is an assistant editor of* PC Magazine.

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Where Is It?

SEARCHING THROUGH FILES WITH DATABASE SOFTWARE

Is finding that one piece of essential data among your text files giving you "needle-in-a-haystack" syndrome? These five text search-and-retrieval programs and free-form databases can help, and we'll rate them for speed and efficiency.

It's there somewhere and we want it: the information we're supposed to have so much access to. We know it's there in our text files, those lengthy repositories of ideas and messages—all kinds of information that we need to be able to search and rescue.

We want it. And we want it fast and easy. The new availability of reasonably priced optical storage devices such as CD-ROMs and optical disks makes us want it even more.

But *dBASE* can't find it. *R:base* can't find it. And our word processors can't find it efficiently enough.

Mainframe computer systems have been able to perform such searches. Now that we have high-performance micro systems, why can't they do it? Just in time, free-form text databases and text search-and-retrieval programs have come to our rescue.

Consider the vast collection of information stored in your word processing files. It's a veritable database, if only you could manage it—if only you could search through all the information and retrieve what you need.

Standard database management programs, which traditionally store data in a field-record-file structure, aren't up to the task of managing or searching text files. These programs treat individual pieces of information as fields, identified by field labels. A collection of related fields forms a record, and similar records are grouped together in a file. Frequently, these programs also link multiple files in a variety of ways to form the functional database.

By storing the contents of important fields in separate locations called indexes or keys, database management programs know where to find your data. Since they control it so tightly, they can search and retrieve specific data quickly. But unfortunately, they're too rigidly structured to manage search and retrieval in diversely structured text files.

■ TEXT-ORIENTED DATABASES

Since most text files originate in word processing format, you might expect your word processor to be able to do the trick. But you'd be disappointed. True, you can use a word processor to search the multiple files for all occurrences of specified words or phrases no matter where they reside. Complicated, Boolean-logic searches, though, are generally beyond the scope of word processing programs. What's more, using a word processor to search text files necessitates loading the files individually, and only one at a time, into the program to view them.

The five programs we look at here offer a range of solutions. Using different methods, they enable you to search and retrieve information from text files, such as company documents and magazine articles, and in certain cases and certain respects, build an actual searchable text database of information from your collection of text files.

Computer Access Corp. had an excellent text database it its product *Bluefish*. Lotus Development Corp., however, purchased Computer Access this year and took its $750 *Bluefish* off the market with promises to return it with even more features. We hope so. *Bluefish* was an easy-to-use program that could support large databases such as legal, medical, and other research files. It also served as a convienient tool for databases of only one or two files.

FREE-FORM DATABASES These programs fall into two categories: free-form text databases and full-text search-and-retrieval programs. Free-form text database programs, such as Seaside Software's *AskSAM* and DayFlo Software Corp.'s *Tracker*, can be a great help when it is used with large individual fields and variable-length records to build free-form databases from text files.

Free-form text databases bridge the gap between tightly structured fielded databases, such as *dBASE* and *R:base*, and between text search-and-retrieval programs as well. The free-form text databases offer the important advantage of being able to deal with the multiple-record structures of text files in order to compile an actual text database (not just an unlinked collection of text files) for you.

FULL-TEXT SEARCH The second type—which includes full-text search-and-retrieval programs such as Access Softek's *Dragnet*, Executive Technologies' *SearchExpress*, and ZyLAB Corp.'s *ZyIndex*—uses various methods to search and retrieve information from text files, usually in ASCII format. In most cases, text search-and-retrieval programs index the text files before they can search and retrieve from them. Some of them recognize fielded data, some use a record data structure, and some use searchable indexes, but all of them offer the distinct advantage of enabling you to search and retrieve information from virtually any kind of existing text files.

■ Programs that convert your text files to a proprietary format and use indexing are the fastest searchers.

Full-text search-and-retrieval software and free-form text database software offer a useful interface to just about any kind of textual information, not just company files and law office archives. The ability of company employees to search an on-line procedures manual, for example, enhances that manual's effectiveness.

Now that electronic versions of text data and lower prices for high-capacity storage media are a reality, vendors are beginning to offer a wide variety of these packages. Unfortunately, none of the programs we evaluated offers everything. Before you select one, you'll need to understand what the different packages offer and how they stack up against each other.

You'll also need to decide which features and capabilities are the most important for your needs and then match those priorities against the programs, selecting the one that offers you the most of what you need. Here's a rundown on what you'll want to consider, in terms of both what you need and what the programs can supply: searching speed, support for complex Boolean searches, ability to store search strategies, file compatibility, storage efficiency, information display capabilities, reliability, and user interface.

SPEED If you're serious about full-text searching and your files are reasonably large, the speed question is one of the first to consider. If the program takes a painfully long time to conduct even a simple search, other considerations pale quickly.

Generally, but not always, programs that convert your text files to a proprietary format and use indexing are the fastest searchers. These programs usually put every word, or every major word, into an index, with pointers to show where they are found. They store each unique word once and include many pointers to show its every location.

Indexing programs generally do not index common words (sometimes called "noise words") such as *a*, *an*, *and*, *the*, and so forth that don't add meaning to the text. Some programs have a small, fixed list of noise words. Others let you decide which words should not be indexed.

The disadvantage of converting text files and then indexing them is that converting an ASCII file to the program's indexed format takes some time. The time factor discourages maintaining frequently changing data in a text database.

Programs such as *Dragnet*, which can search many file formats—those of word processors, *dBASE*, ASCII, and others—offer the most versatility. They permit you to store search strategies and filenames, and they can replay a search anytime, as long as the source files remain in the same subdirectory.

Unfortunately, these programs sacrifice speed for flexibility. One of our sample searches took *Dragnet* 5 minutes. The same search in *AskSAM* was instantaneous, and *WordPerfect* took about 40 seconds.

SEARCH STRATEGY The best programs can conduct complex searches, modify the search logic easily, and store search criteria. Ideally, you want a program that can do more than just find all occurrences of a single word or even a phrase. You need one that can exclude cer-

Text-Oriented Databases: Summary of Features

(Products listed in ascending price order)

	Dregnet Access Softek	SearchExpress Executive Technologies Inc.	Tracker DayFlo Software Corp.	AskSAM Seaside Software Inc.	Zyindex ZyLAB Corp.
List price	$145	$150	$150	$200	$295
CAPACITY					
Max. record/paragraph size (bytes)	Unlimited	65.5K	32K	1.6K	N/A
Max. no. of records/paragraphs per file	Unlimited	65,525	Unlimited	Unlimited	N/A
Max. no. of documents per database	Unlimited	1 million	65,000	Unlimited	5,000
Max. no. of words per document	Unlimited	32,000	32,000	Unlimited	64,000
Max. file size (pages)	Unlimited	Unlimited	Unlimited	Unlimited	300 (2K per page)
DATA INPUT					
Free-form files	●	●	○	●	●
Named fields	○	●	●	●	○
Text editor	○	○	●	●	○
DATA MANIPULATION					
Full-text searches	●	●	○	●	●
Field searches	○	●	●	●	○
Indexes	○	●	●	○	●
Max. no. of unique words indexed	None	Unlimited	Unlimited	None	125,000
Uses Boolean logic	●	●	●	●	●
Sorts data	○	○	●	●	○
FILE FORMATS					
Proprietary	●	○	○	○	●
Imports/uses ASCII files	●	●	●	●	●
MISCELLANEOUS					
Spreadsheet reporting	○	○	●	●	○
Math support	○	○	●	●	○

—Indicates Editor's Choice ●—Yes ○—No
N/A—Not applicable: *Zyindex* does not break files into paragraphs.

tain "hits," or "finds" (occurrences of a word), find complex groupings, and let you specify how far away from each other certain words will be found.

Until recently, only large mainframe packages supported this level of sophisticated text searching and retrieval. Now most serious microcomputer text database and searching software can handle these tasks. For example, they enable you to find all references to WORD1 and WORD2, but not WORD3, only when WORD1 and WORD2 are eight words apart. You can even specify that WORD1 and WORD2 must both appear in the same sentence or paragraph.

At times you'll want to construct a search strategy on the fly, using the results of successive searches to narrow down the amount of data you find. You'll need a database program that allows you to use the results of one search and modify it with additional criteria. Using syntax similar to S1 AND NOT WORD3, for example, you can tell the program to exclude from all the found records in the first search (S1) anything that includes WORD3.

Also, you should be able to use parentheses for complicated expressions. The sample search (S1 AND NOT WORD3) AND (WORD4 W8 WORD5), for example, means to exclude references to WORD3 from the first search and to select only the remaining records that contain both WORD4 and WORD5 when WORD5 is within eight words of WORD4.

Another useful addition to full-text searching is the ability to establish searchable fields. Having some fielded data within a large body of text can reduce search time by eliminating whole documents if

the fielded headers don't match the search request. It can also add flexibility to the program's reporting capabilities. Supporting searchable fields diminishes speed, however.

USER INTERFACE Most users agree that text database and searching programs should be command oriented. Support for prompted searches is fine, but you should be able to bypass menus and prompts in favor of a straight query. Although you could, for example, construct a complicated search such as (S1 AND NOT WORD3) AND (WORD4 W8 WORD5) from a menu, you'd have to use a large number of steps, and the procedure would be clumsy.

At a recent conference on database searching techniques, one participant complained that he had wasted valuable time and money trying to conduct a useful search through an on-line database. He wondered why menu-driven software wasn't available from the database vendor to help him.

He was in the minority. Other members of the audience disagreed quickly, saying that while query language searching is a little harder to learn, it provides better overall speed and functionality. The only database users who seemed content with heavily prompted searching were those just getting started or who used on-line searching only occasionally.

Once your program has conducted a search, you need to be able to scan the text quickly and easily. You'll want a program that has a user interface that does a good job of presenting the text data for review, printing, and reporting.

Most of the products we evaluated have acceptable user interfaces, but a couple did not. *SearchExpress*, for example, rewrites the entire screen each time you move the cursor down one line in the displayed document. The rewriting of the screen is annoying enough, but the fact that the program takes about 2 seconds to display each new line is unacceptable.

Another example of an information display system that could benefit from some improvement is that of *Dragnet*. This program searches the full text of one or multiple documents and transfers single lines, sentences, or paragraphs to a results document for viewing. You can see all the hits this way, but you don't see them in the full context of the original document, unless you exit *Dragnet* and load up the original.

A few text database and searching programs offer a database reporting capability in addition to simply printing all or parts of the found document. In this way you can scan multiple documents for specific data and print it in a conventional database format. Although this capability usually requires explicit or implicit field definitions, which may require additional effort in building the database, the investment pays off since summary reports from a text database can be extremely useful.

FILE COMPATIBILITY If you are looking for a program that can handle dynamic files in a variety of formats, make sure it supports the file structures you use. Most indexing programs (*ZyIndex* is one exception) convert your data to a proprietary format. Direct access of files in their native format is usually slower than access in a custom format, but it offers additional flexibility.

When you move data into a custom format, you need to store some information at least twice: once in the format the information was originally generated in and again in the database format. Particularly when disk storage space is a consideration, make sure you have the total overhead required to operate your application.

Some text search-and-retrieval programs compress data when they import it from another format, reducing slightly the amount of incremental storage required. But remember that indexing programs store every important word of all imported documents in an index, adding to storage requirements.

Obviously, when you turn over valuable data to a database software package, you want reliable operation. None of the programs we evaluated lost data, but they did not always work as advertised. Some of our search requests occasionally failed to find data we knew was in the file, some routines worked more slowly than we thought was acceptable, and some other minor problems occurred. Overall, though, the difficulties we experienced with this round of relatively new products were no more significant than those we'd expect from any group of programs.

The capabilities of the software we evaluated run from pretty basic to surprisingly complete, and we saw enough to be encouraged. With a few more months of development time and the increased pressure of competition, the market should yield a second round of products, offering features and resources to handle larger and more-complex applications.

AskSAM

A $200 free-form, text-based database management system, Seaside Software's *AskSAM* has an unusual, even funny, name. But when you know what it means (it's an acronym for Access Stored Knowledge via Symbolic Access Method), it sounds more impressive. And it is—*AskSAM* is an impressive general-purpose text management tool (including a phone dialer) that can handle a variety of applications, from bibliographies and research notes to address lists and financial data.

AskSAM supports both fielded and full-text data. It can conduct full-text searches for single words or phrases, including searches with Boolean logic. Although the program does not use indexing, its search-and-retrieval speeds are close to those of products that do.

You can import ASCII text files from other applications. In addition, *AskSAM*'s built-in text editor enables you to create or edit file records.

EDITOR'S CHOICE

PC MAGAZINE FACT FILE

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Seaside Software Inc.
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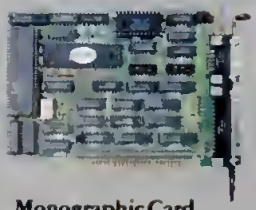

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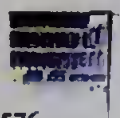

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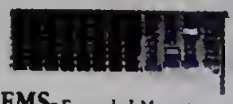

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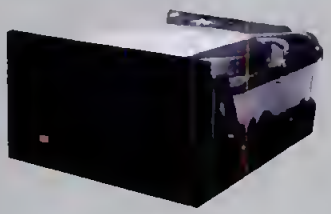

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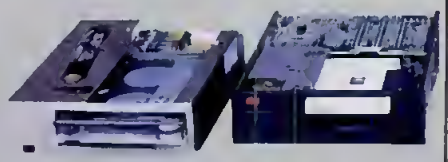

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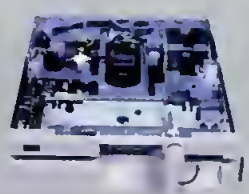

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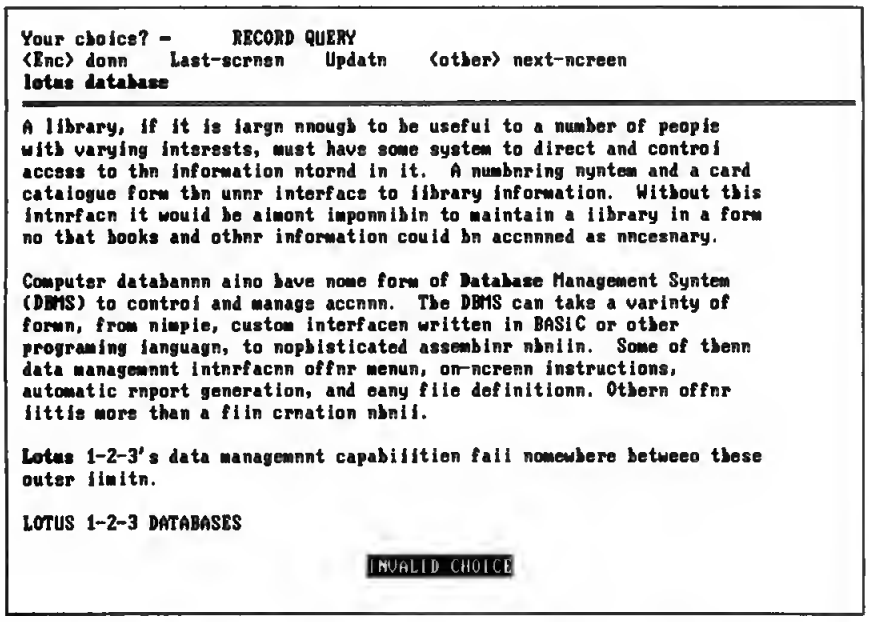

AskSAM *will normally identify a paragraph as a record following its search, as it did when it conducted this two-word search.*

The program works with words, records, documents, and files. A word is virtually any combination of up to 80 characters that does not contain spaces. A record is a group of words up to 1,600 bytes, or an 80- by 20-line screen. You can specify how *AskSAM* should define a record, using a blank-line separator, a set number of lines (up to 20), or any two-character code.

Disk size is the only limit to the number of variable-length records you can have in a single file. You can create as many *AskSAM* files as you like, but only one file can be active at a time.

The capability of the program to link records to form logical documents expands the record-oriented search and thus enhances searching. Individual records retain their identity even when linked into logical documents. And switching between document and record mode is easy.

AskSAM's support for field labels within records adds to its flexibility. Unlike conventional database software that generally uses a set number of field labels and fixed-length fields, *AskSAM* can use variable-length fields anywhere in a record or document. The only real limitation is that the field name (label) and the field contents (data) must reside together on a single 80-character line.

The program supports implied, explicit, and contextual field types. An implied field is set off with one or more unique characters, such as a dollar sign ($), a double-plus sign (++), or a tag such as AMT or QTY. An explicit field uses a field label with the attached contents enclosed in brackets (NAME[John Smith] or COMPANY[Amalgamated Software]).

You can also set up contextual fields with ordinary field labels, such as NAME John Smith or COMPANY Amalgamated Software. Contextual field definitions can be flexible, but they aren't as precise as explicit fields.

The type of field structure you use depends on the data you are storing and the type of retrieval and reporting you require. The advantage of the program's versatile field-structure support is that you can enter raw data as it is captured and then establish searchable fields later. But although searching on field labels provides a more precise algorithm, field-oriented searches are considerably slower than full-text searches. Also, manipulating data at the field level is extremely complex.

SPEEDY PROGRAM *AskSAM* imports text files into its own database structure extremely fast. One 50K-byte file we tested became part of a larger, existing *AskSAM* file in just 30 seconds. Searches are also fast, and record-level or full-document text display is very rapid.

You can skip from record to record, scroll through the entire document, or look at records that contain only the specified search strings. The display shows the cursor location within the document.

AskSAM uses both menus and commands. A one-screen menu system accesses all major software functions. The menu system helps you move easily around the software, and finding information is as simple as entering the information you want to find on a query line. By entering words and phrases on the search command line, you can retrieve matching records. In addition, built-in *AskSAM* commands support further data manipulation. For example, you can specify document or record searches or look for information by field labels or field contents. Additional commands specify where search strings must occur (AFTER certain words or fields, for example).

Accessing full-text data with simple words and phrases is extremely easy with *AskSAM*. More-sophisticated searching, however, requires more work. Although the command language uses Lotus-type curly bracket commands with a fairly obvious syntax, you have to learn it. This command-oriented approach to data manipulation provides more flexibility than all-menu searching, but it requires a higher level of expertise. *AskSAM* simplifies repetitious search-and-reporting scenarios, though: it lets you store program commands inside a database record for recall and playback.

The program's command language is more than a searching tool. It also gives you file modification, mathematical operations, and flexible reporting features. And it can produce tabular or spreadsheet-type reports based on field and record contents. (Although a powerful addition, this reporting feature is not easy to use.)

One of the program's major strengths is its menu support coupled with its powerful command mode. When you're new to the program, you can work at the menu level. As you learn more about the program and your data manipulation needs change, you can use the command structure.

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High Resolution Monitor:
13V″ • 4,800 characters, 640 x 480 graphics resolution • Analog video input 31.5KHz • Infinite colors 0.28mm fine dot pitch

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CIRCLE 373 ON READER SERVICE CARD

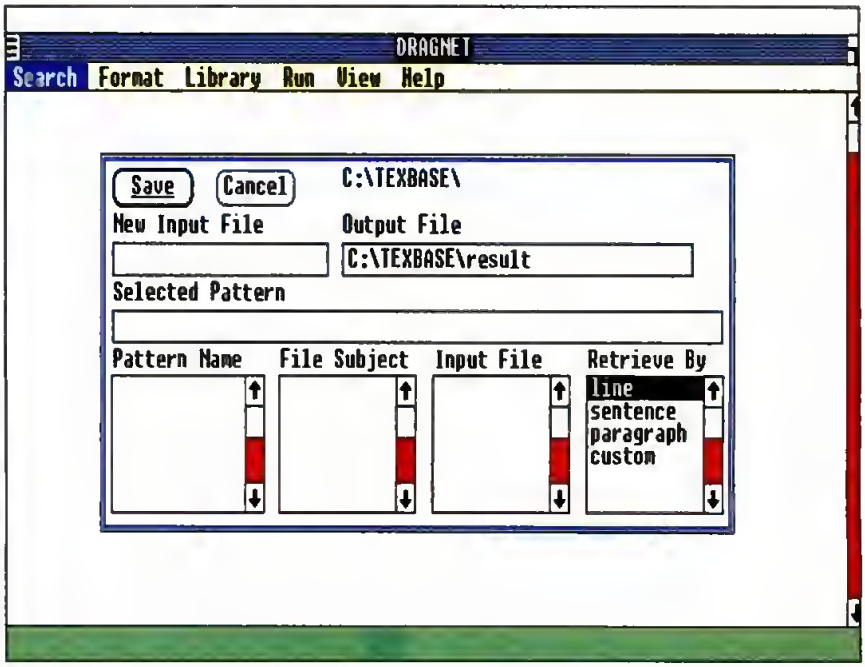
With its flexibility, speed, and $200 list price, *AskSAM* is not only an exceptional value, it's one of those programs that users at first marvel at and then come to treasure.

Dragnet

The concept behind Access Softek's $145 *Dragnet* is a good one: open a flexible, icon-driven, mouse-controlled window into a database of text files without requiring special installation or indexing procedures. The reality, however, is that even beginning text searchers probably will become frustrated with *Dragnet*'s cumbersome requirement of opening two windows to specify file search criteria.

And the slow search times that result from having no index files will discourage you from the start. One simple search of a single 72K-byte file, for example, required 4 minutes, 37 seconds, to create an output file containing 20 hits. This search in *WordPerfect*, using manual keyboard techniques, takes about 40 seconds. (*WordPerfect* and other advanced word processing programs also search for word patterns across multiple files, and *WordPerfect*, for one, does it faster than *Dragnet*.)

Moreover, *Dragnet* searches an input file or files for the specified word pattern, and it copies lines, sentences, or paragraphs that contain hits to a separate output file. When you view found information, you see a document name, page number, and line number beside the extracted text. Since you're not viewing the found text within the context of the full document, the usefulness of this type of retrieval is very limited.



Dragnet *operates in a* Microsoft Windows *environment. The underline indicates where you are in your search. Here it indicates Save. To begin a search you move the cursor to the Selected Pattern field and type the word you are seeking.*

The positive side of *Dragnet* is its support for Boolean search logic (something few word processing programs offer) and its ability to work with a variety of file formats from word processing programs, spreadsheets, and databases. *Dragnet* is also useful for one-time or infrequent file searches, since search and retrieval of a nonindexed file takes less time than indexing the file and then searching it. The program will let you store search strategies for later reuse.

Dragnet is easy to install, and, because of its *Microsoft Windows* interface, learning to use it is a cinch. Pull-down on-line help virtually eliminates the need for a user manual.

In fact, *Dragnet*'s strongest feature is its mouse-driven icon interface. The package supplies a subset of *Microsoft Windows*, but with the full *Windows* software *Dragnet* can operate in the background in its own window—an important feature with a program this slow.

The mouse-driven window interface is a novelty, for a while. But users accustomed to entering commands or search patterns directly from the keyboard will quickly tire of the point-and-click procedure. Luckily, mnemonic Ctrl-key combinations are available to speed up the process a little.

Although *Dragnet* is easy to use, functions as advertised, and presents no problems during installation and operation, its value over an enhanced word processor is questionable. If you require only an occa-

■ *Dragnet* is easy to install, and, because of its *Windows* interface, learning to use it is a cinch.

PC MAGAZINE FACT FILE

DRAGNET

***Dragnet*, Version 1.0**
Access Softek
32004 Adeline St.
Berkeley, CA 94703
(800) 222-4020
(415) 654-0116
List Price: $145
Requires: 256K RAM (512K recommended); two disk drives (hard disk recommended); EGA, CGA, or Hercules graphics adapter; DOS 2.0 or later; *Microsoft Windows* and mouse recommended.
In Short: ASCII file search program that works without indexing or changing the original file; slower than a word processor such as *WordPerfect* for multiple-file text searching and retrieval, but offers Boolean logic and other search features. Not copy protected.

CIRCLE 671 ON READER SERVICE CARD

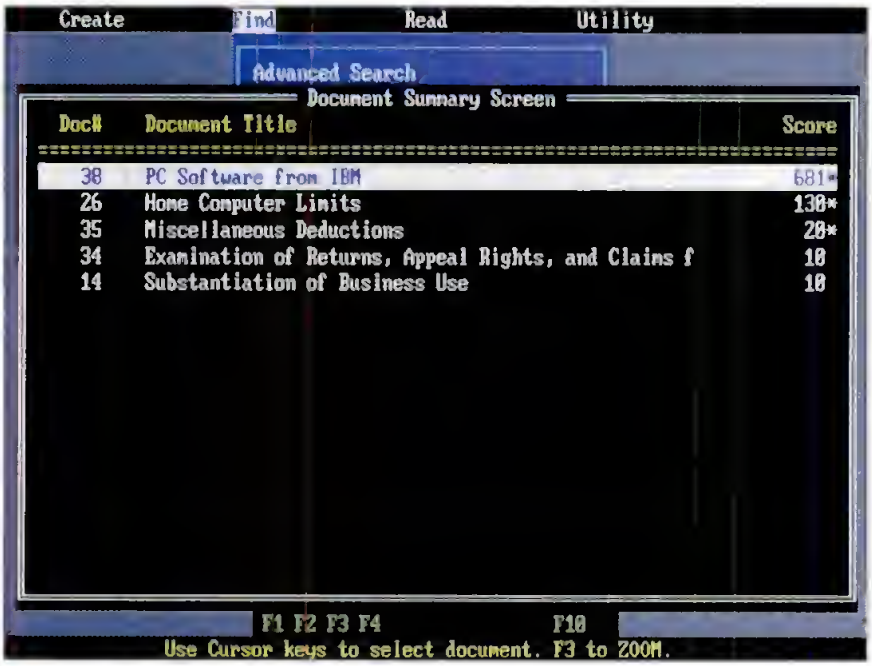
sional text file search or want to experiment with the *Windows* environment in a real application, you may find *Dragnet*'s $145 price a worthwhile investment. Otherwise you'll want to turn to one of the more-full-featured programs reviewed here.

SearchExpress

SearchExpress, a $150 program from Executive Technologies, is a sophisticated, powerful tool for searching and manipulating a large database of text files. It first converts standard ASCII text files to its own compressed format and builds keyword indexes to the data. The program displays entire documents or selected parts of documents on command. It also includes a print program.

Two versions are available. Version 1.1 (the one we reviewed) supports up to 1,000 documents, works only with magnetic media, and retails for $150. Version 2 supports up to 1 million documents and is available for magnetic media at $495 or for write-once optical media at $695.

The best application for *SearchExpress* is as a window into a relatively large, mostly static database of text, such as an on-line encyclopedia or an archive of legal documents. The program's search specification screens offer an easy-to-use vehicle that is great for ferreting through a large body of text for specific information.



SearchExpress *gives you a "score" indicating the number of documents it finds. The score reflects the number of hits on a specified word and also shows the specified weight for each word.*

The process can be lengthy, since *SearchExpress* must convert each document it searches into its proprietary format and create an index for it. One 40K-byte document we tested took almost 10 minutes to install. Moreover, documents must be in a straight ASCII format with no control codes or special characters, and all files must have a .TXT extension.

BOOLEAN SEARCHES *SearchExpress* goes beyond simple text file searches for keywords or phrases, using Boolean operators (AND, NOT, OR). It also enables you to establish links among pages in multiple documents. This feature can, for example, help you tie briefs or outlines to the appropriate sections of larger documents, as well as annotate documents. You can link up to 249 separate documents to a master.

The program operates only on documents that reside in its directory. After you install the document in the *SearchExpress* database, it does not appear in the directory under its original name, and you can't view the program outside the *SearchExpress* environment.

Installation and setup are particularly easy and straightforward. Although *SearchExpress* will operate on non-ASCII files, it may drop some words during the conversion. But we experienced no major problems.

The program is basically easy to use. A Lotus-type horizontal menu gives you access to all operations; second-level menus appear in pull-down boxes, instead of in a single line as in Lotus. A large template serves as a guide to using the function keys, which sometimes perform inconsistently. In some cases, for example, you can use F4 (UnZoom) to back out of an operation; in other cases you must use the Esc key to perform the same task.

When we tested *SearchExpress* with a database of about 40 documents, some as large as 40K, we found the program's search process surprisingly quick. The advanced search screen allows up to nine search words and phrases. Searches are easy to define, using either a simple word search or Boolean logic. You can enter up to seven words on the prompted word search screen, assigning each word a relative number indicating how important it is in the search. *SearchExpress* lists retrieved

PC MAGAZINE FACT FILE

***SearchExpress*, Version 1.1**
Executive Technologies Inc.
1075 13th St.
South Birmingham, AL 35205
(205) 934-9130

List Price: $150
Requires: 437K RAM, two disk drives (hard disk recommended), DOS 2.0 or later.
In Short: Text search-and-retrieval package that converts ASCII files to compressed format and creates indexes; searches are quick, but document viewing is slow and cumbersome. Version 2.0 available that supports optical disk storage. Not copy protected.

CIRCLE 670 ON READER SERVICE CARD

Other comp
trying to get

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anies are still to first base.

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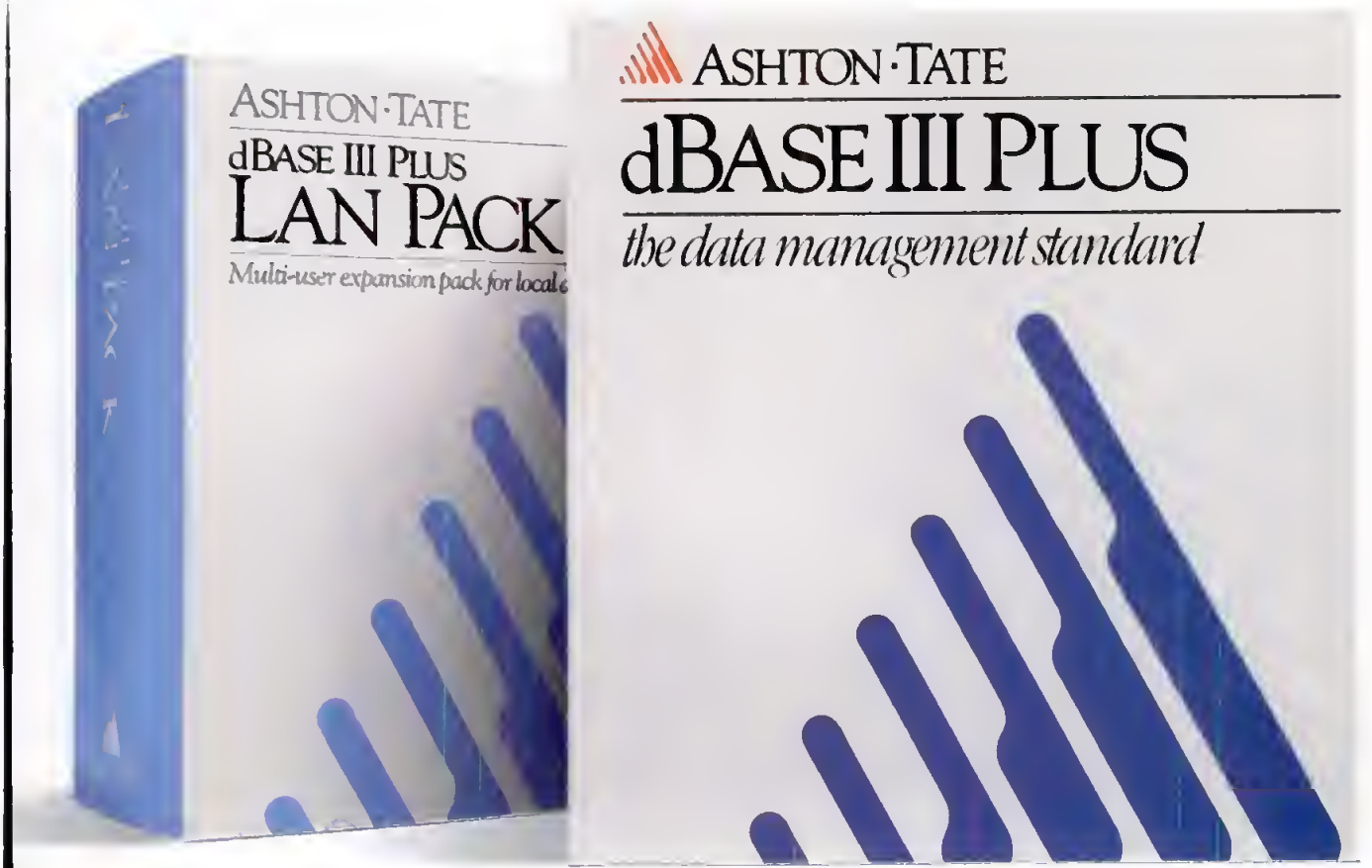
For more information or the name of the dealer nearest you, call (800) 437-4329, Ext. 284.*



CIRCLE 208 ON READER SERVICE CARD

■ *SearchExpress*'s search strategies and ability to link several documents can add considerably to an existing text database.

documents in order according to how many hits occurred and with the weight number assigned to each word.

Like Dialog and other on-line databases, *SearchExpress* lets you refine the search strategy by combining specifications. You use Dialog's "S1," "S2," and so on, search strategy designations to do so. For example, search strategy S1 might be COMPUTER AND 386, and S2 could be S1 AND NOT COMPAQ.

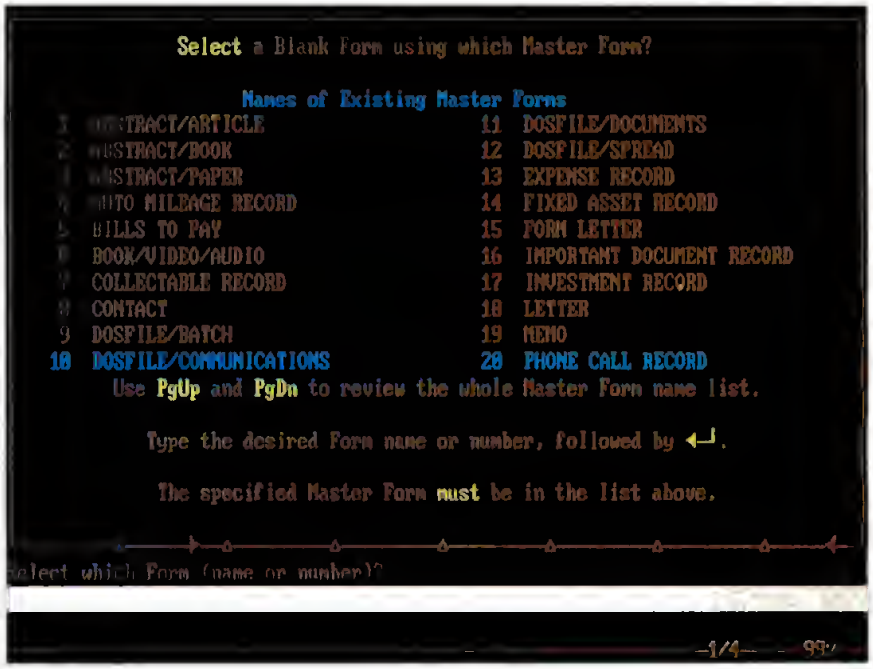
Unlike the search process, the document view function is frustratingly slow. As mentioned previously, since *SearchExpress* stores and searches documents in a compressed format, it must preprocess them before displaying them. On a 4.77-MHz machine, it can take several minutes to decompress a large file.

Moving around the displayed document is slow also. *SearchExpress* rewrites the entire display as the top line scrolls off the screen, requiring about 2 seconds per line.

The program's strongest suit is its ability to handle many large documents. If your requirements fall within its capacity and you are not troubled by its slow file display and cumbersome interface, *SearchExpress* offers a lot for a low price. Its comprehensive search strategies and ability to link several documents can add considerably to an existing text database.

Tracker

DayFlo Software Corp.'s *Tracker*, which sells for $150, falls between a traditional database and a text search-and-retrieval tool. Essentially a free-form text database program, it's designed to track variable-format information.



Tracker*'s Blank Forms screen shows some of the record formats available to you. Some of these are supplied with the basic software; others come with the optional* Applications Pack.

Tracker can hold a large number of record formats in each database file, with record structures as tightly defined or as loosely structured as you desire. It supports records up to 32K bytes long, as well as indexed and full-text searches.

Before entering new information, you select the appropriate record structure from among the ones *Tracker* has on file. The package comes with some record structures already defined—memos, automobile mileage, expenses, letters, and a lot more—and you can easily construct your own data formats.

Tracker uses a Lotus-type light-bar menu at the bottom of the screen. Experienced users will find that the full set of function keys and special keystroke combinations add flexibility and speed. The program also offers good feedback, including error reporting. On-line, context-sensitive help is always available.

Defining a record layout with *Tracker* works the same as it does in many database packages. A full-screen editor lets you place field labels where you want them, and you can specify the type of information for each field, the field length, and an information mask that forces certain types of data entry. An optional applications pack supplies additional preformatted record structures, which you can use instead of designing your own.

Tracker stores field definitions in a dictionary, for other record structures to use

PC MAGAZINE FACT FILE

***Tracker*, Version 1.1**
DayFlo Software Corp.
17701 Mitchell Ave.
North Irvine, CA 92714
(800) 367-5369
(714) 474-1364
List Price: $150; applications package, $40.
Requires: 384K bytes of RAM (additional RAM recommended), hard disk, DOS 2.0 or later.
In Short: Variable-record-structure database that supports indexed and full-text searches. Reasonably quick and easy to use, it supports ASCII file input from other applications. Not copy protected.

CIRCLE 188 ON READER SERVICE CARD

as necessary. For example, you can create a name-and-address file that contains Last Name, First Name, Company, Address, City, State, ZIP code, and Telephone fields. At a later time, you can define a form letter record that uses some or all of these same field definitions without having to set up the matching fields again.

You can store as many different data types as you like in a single database file and select records for viewing, printing, or for custom reports on the basis of field labels or contents. You can also create multiple database files, each with its own field and record definitions, but you can work with only one file at a time.

Tracker supports multiple field entries, separated by a Ctrl/E (). This feature enables you to use a general label such as KEYS or KEY DATA, for example, which can have multiple entries. You might want to flag a record by company type, product type, reason for contact, or other variable data so that *Tracker* could retrieve the record by using a variety of search criteria.

Tracker is not one of those products that offers a manual primarily to hold the floppy disks. Although you can install the software, move around the menus, and even edit some records without studying the manual much, you'll need to spend some time to learn how to use the program effectively.

For one thing, some functions operate in unexpected ways. For example, *Tracker* always assumes you will work with the currently displayed record or record format, unless you first move all records out of the stack work area and into a file. This procedure actually offers a high level of flexibility and, once learned, is natural enough, but you have to make an effort to learn it. Fortunately, *Tracker*'s well-written manual helps considerably.

Another difficult function to use correctly the first time is the TextIn feature, which lets you import text files from another database, spreadsheet, or word processing application. Using TextIn takes some study and planning but produces a database that can combine data from a variety of files into a single, flexible, searchable application.

One intriguing use for *Tracker* would be as a memory-resident, pop-up application. Used with a memory-partitioning program such as *Double-DOS* (and with sufficient memory not to cripple it and your other applications), it could give you instant access to memos, letters, addresses, telephone records, and the like.

An excellent general-purpose data managing and filing program, *Tracker* has many powerful features and enough flexibility to make the $150 investment pay off in many business, professional, and educational settings.

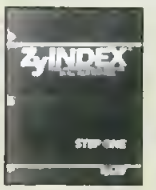
ZyIndex

Available for $295, ZyLAB Corp.'s *ZyIndex* straddles two types of programs that search text files: programs that do not use indexing (*Dragnet*, for example) and those that do full indexing after moving text files into a proprietary format. *ZyIndex*'s chief claim to fame is that it not only does indexing, it indexes and does searches and retrievals on files in their native format—a valuable capability for those who must manage a variety of files that are constantly changing.

Three versions of *ZyIndex* are available: Standard, $145; Professional, $295; and Plus, $695. Each higher version of the program handles larger files and more indexed words. In addition, the Plus version is designed for use on a network or multiuser workstation.

ZyIndex Professional, the version we evaluated, can fully index up to 5,000 files and maintain a "files-only" list for up to 15,000 files. With full indexing the program remembers not only which files contain the specified search words, but where

FACT FILE

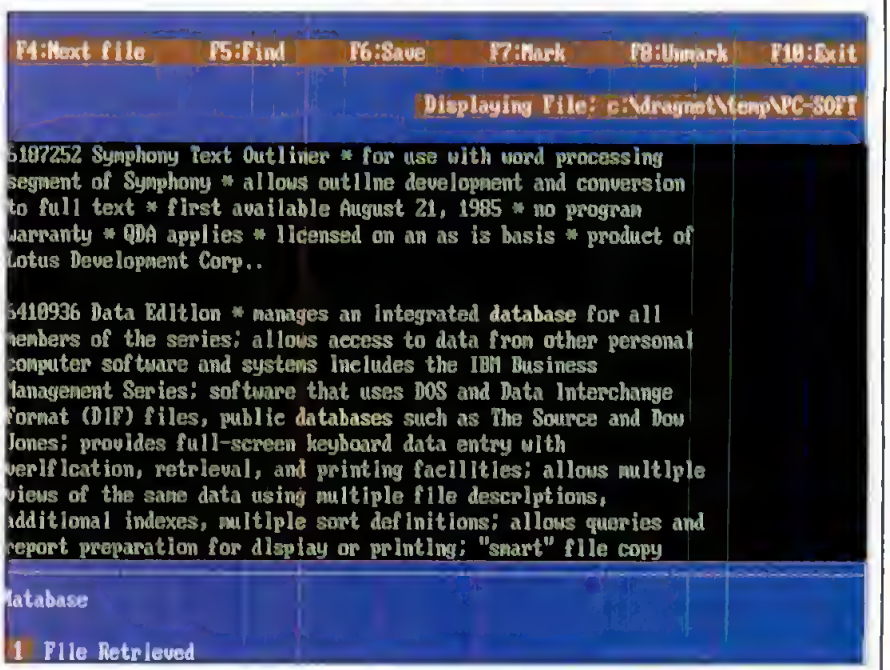


***ZyIndex* (Professional), Version 2.20**
ZyLAB Corp.
233 E. Erie St., #407
Chicago, IL 60611
(800) 544-6339
(312) 642-2201
List Price: $295

Requires: 256K RAM (additional memory recommended), two disk drives (hard disk recommended), DOS 2.0 or later.

In Short: Full-text search-and-retrieval software that supports most word processor formats, creates proprietary index to native files, and displays found text in its original context. Standard and Plus versions also available. Not copy protected.

CIRCLE 668 ON READER SERVICE CARD



ZyIndex *highlights the words it finds within a document after it completes its search.*

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CIRCLE 167 ON READER SERVICE CARD

■ TEXT-ORIENTED DATABASES

these words are located within the file. A files-only index tracks only the file. The professional version can maintain a list of up to 125,000 unique words. That's probably adequate for most PC users, but if you need more, the Plus version can keep a list of up to 500,000 unique words.

The proprietary-format approach of other indexing programs gives them more control over display formats as well as a speed advantage, but the *ZyIndex* method obviates the need to keep duplicate copies of files to be searched. Of course, if you modify an indexed file, rename it, or move it to another directory, *ZyIndex* can't operate correctly until you create another unique index.

ZyIndex works at a speed comparable to that of other indexing programs. It completes searches almost instantaneously and displays files reasonably fast. (But it doesn't display files as quickly as, say, *AskSAM*, presumably because of the speed penalty exacted by its need to prepare a non-ASCII file for display before putting it on the screen.) After it searches the index, *ZyIndex* displays a list of files that contain the specified string. You then view the files, one at a time, selecting them by pointing to the filenames with a highlighting cursor.

For a complete display, you must indicate the format of each file. Although you specify a default format when installing the program, you can change the format before displaying a file. This capability enables you to maintain a master index across a database of files in various formats. (One minor disappointment: *ZyIndex* has trouble when it encounters a few word processing codes, so occasionally you may come across some strange stray characters in displayed files.)

■ *ZyIndex* works at a speed comparable to that of other indexing programs. It searches almost instantaneously and displays files reasonably fast.

STANDALONE FILES *ZyIndex* consists of two standalone program files: one adds new entries to the index, and the other searches the index and displays found files. You start both programs from the DOS prompt, and both offer a clean, easy-to-use interface.

A brief quick-reference manual includes all the information you need to get *ZyIndex* up and running and to start indexing files. The full user manual helps you construct searches and offers additional program details, but experienced computer users can easily use *ZyIndex* right out of the box.

By maintaining files in their native word processing formats, *ZyIndex* offers convenience and flexibility for full-text searching. And with three versions at different prices, it affords a variety of features and capacity levels that you can match with your individual needs. PC

Tom Badgett is a computer industry researcher and free-lance writer based in New Jersey.

PC MAGAZINE EDITOR'S CHOICE

• **AskSAM**

All of these programs have something good to offer, but none has it all. AskSAM, *from Seaside Software, comes closest.*

AskSAM *scores high for its flexibility, its text editor, and its reporting features. It imports ASCII files into a text database format extremely fast and does searches lickety-split.* AskSAM *supports three types of database fields, and you can create columnar reports from them. The command language could be easier to use, but it gives you exceptional flexibility.*

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**This offer applies only to the Mouse Systems' PC Mouse product brand*

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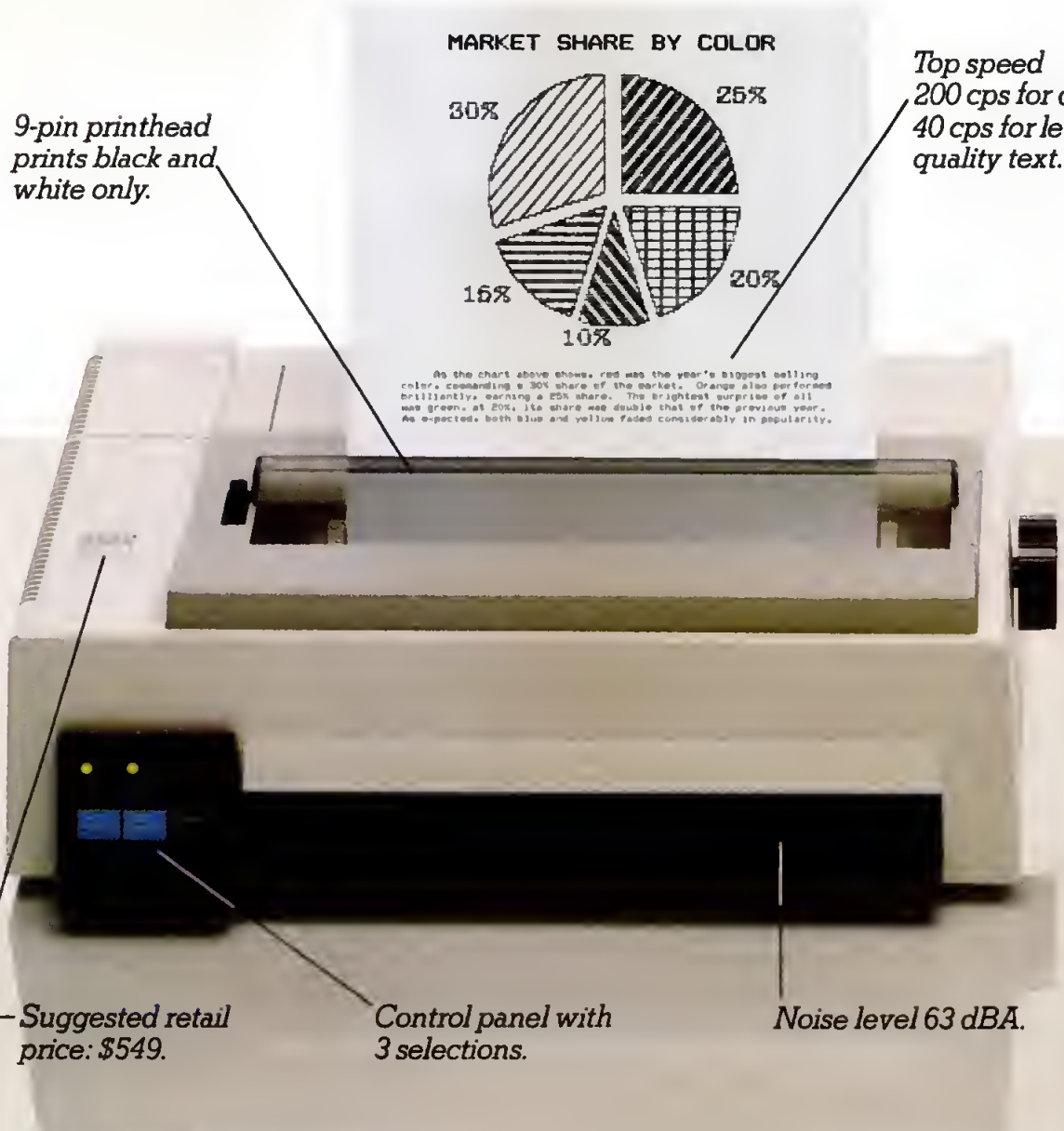
HOW TO B



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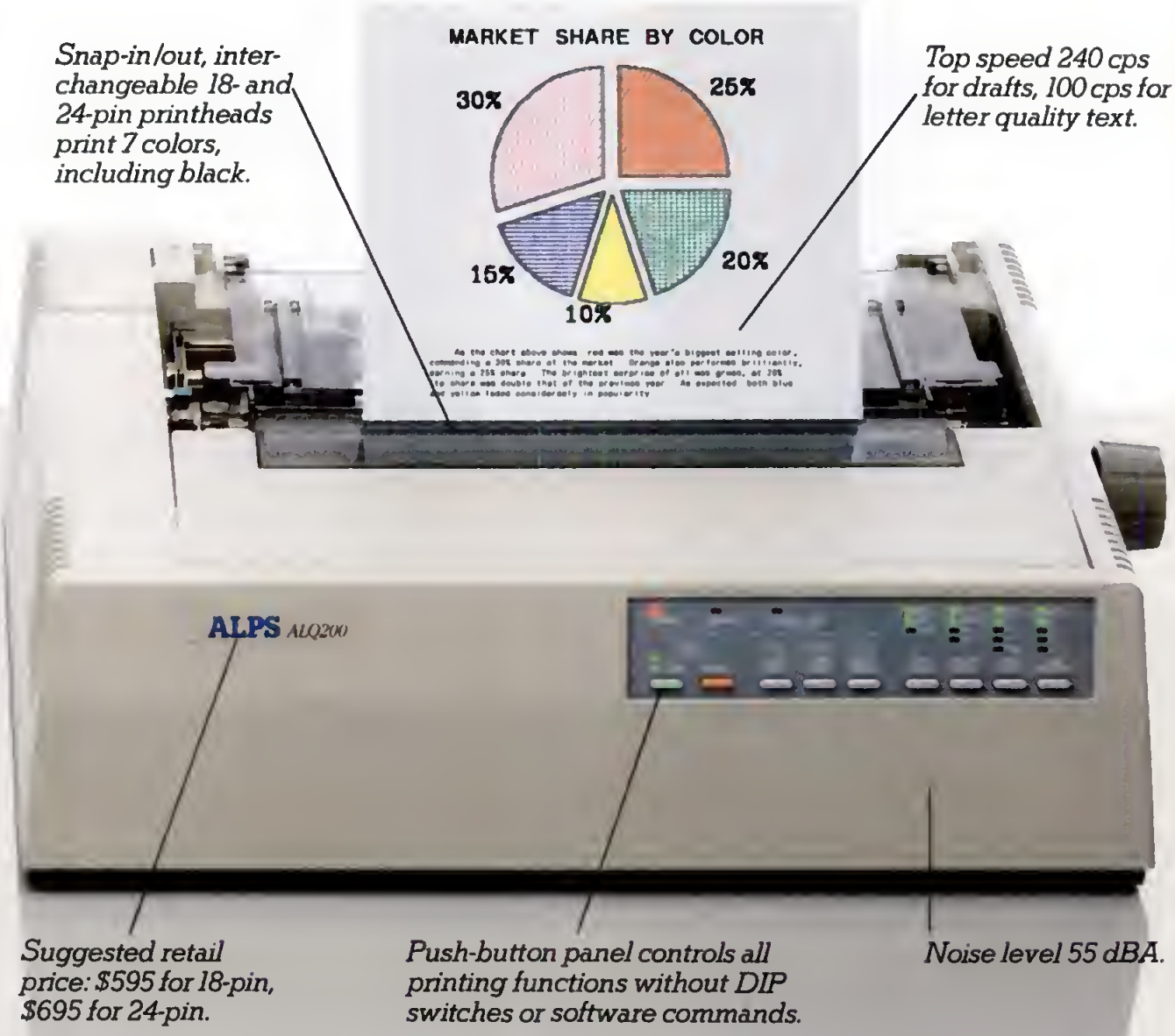

Suggested retail price: $595 for 18-pin, $695 for 24-pin.

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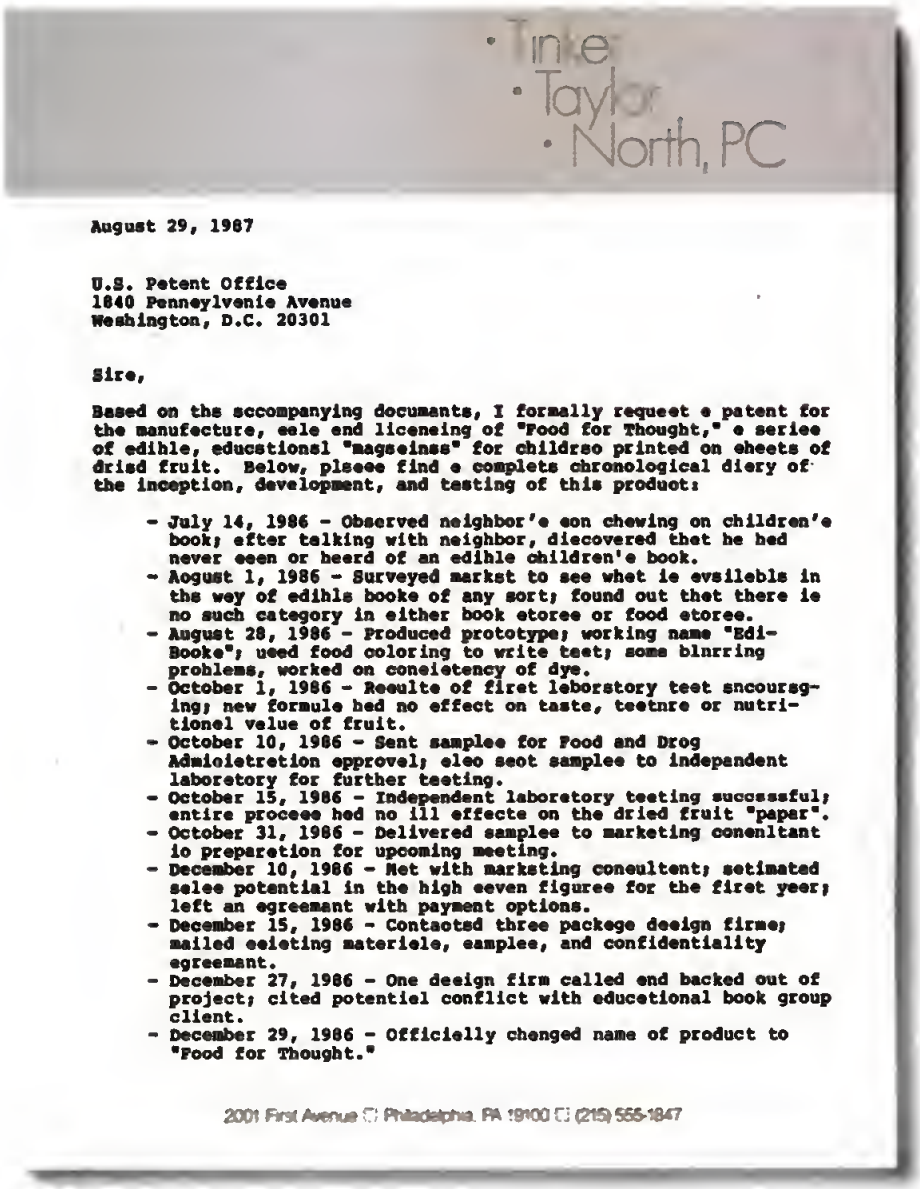
The DAISYWHEEL makes points...



· Tinker
· Taylor
· North, PC

August 29, 1987

U.S. Petent Office
1840 Penneylvenie Avenue
Weshington, D.C. 20301

Sire,

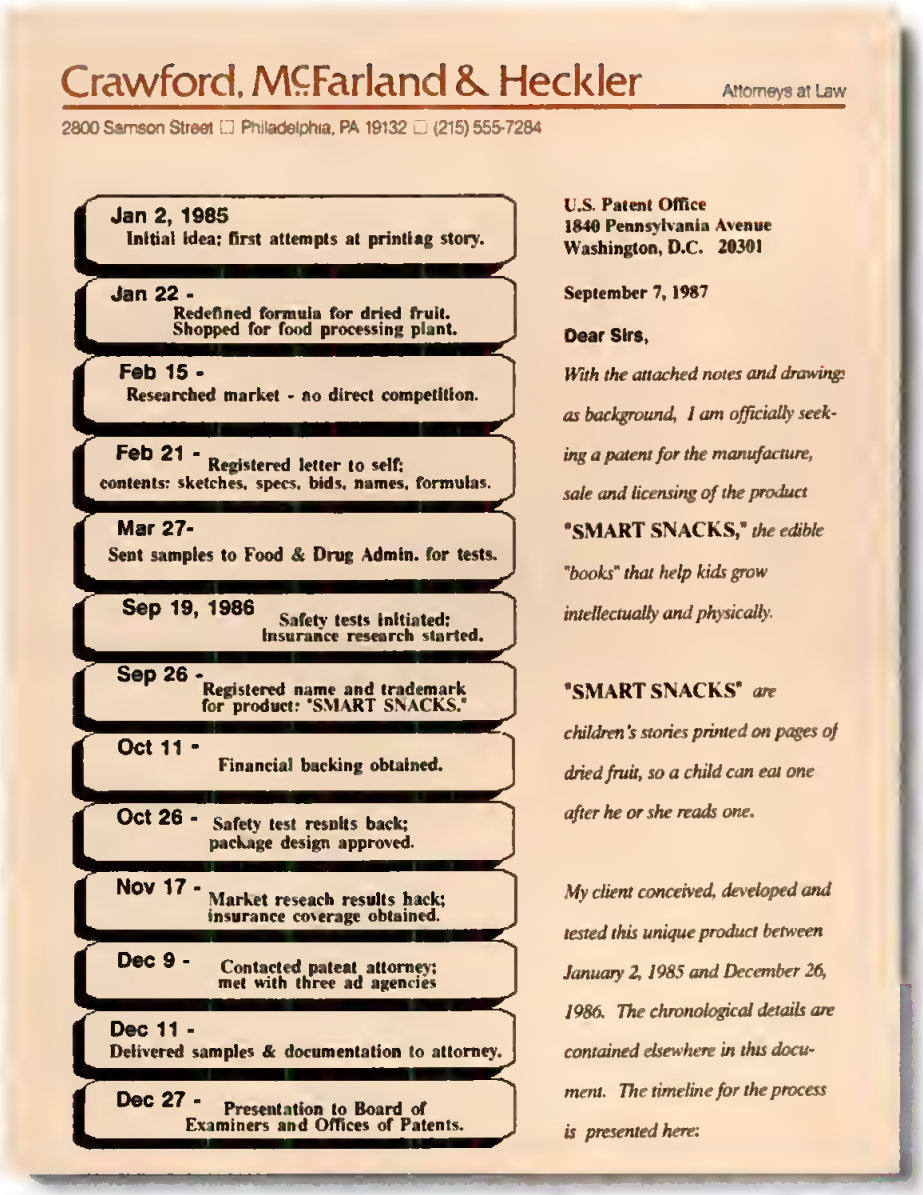
Based on ths sccompanying documants, I formally requeet e patent for the manufecture, eele end liceneing of "Food for Thought," e seriee of edihle, educstionsl "magseinss" for childrso printed on eheets of drisd fruit. Below, plsee find e complets chronological diery of the inception, development, and testing of this produot:

- July 14, 1986 - Observed neighbor'e son chewing on children'e book; efter talking with neighbor, diecovered thet he hed never seen or heerd of an edihle children'e book.
- Aogust 1, 1986 - Surveyed markst to see whet ie evsilebls in ths wey of edihls booke of any sort; found out thet there ie no such category in either book etoree or food etoree.
- August 28, 1986 - Produced prototype; working name "Edi-Booke"; ueed food coloring to write teet; some blnrring problems, worked on coneietency of dye.
- October 1, 1986 - Reeults of firet leborstory teet sncoursg-ing; new formule hed no effect on taste, teetnre or nutri-tionel velue of fruit.
- October 10, 1986 - Sent samplee for Food and Drog Admioietretion epprovel; eleo seot samplee to indepandent laboretory for further teeting.
- October 15, 1986 - Independent laboretory teeting successful; entire procese hed no ill effecte on the dried fruit "paper".
- October 31, 1986 - Delivered samplee to marketing conenltant io preperetion for upcoming meeting.
- December 10, 1986 - Met with marksting conoultent; setimated selee potential in the high eeven figuree for the firet yeer; left an egreemant with payment options.
- December 15, 1986 - Contaotsd three packege deeign firme; mailed eeleting materiele, eamplee, and confidentiality egreemant.
- December 27, 1986 - One deeign firm called end backed out of project; cited potentiel conflict with educetional book group client.
- December 29, 1986 - Officielly chenged name of product to "Food for Thought."

2001 First Avenue ☐ Philadelphia, PA 19100 ☐ (215) 555-1847

REGISTERED TRADEMARKS: OKIDATA, Oki America, Inc., Marque déposée de Oki America, Inc.; LaserJet and LaserJet Plus, Hewlett-Packard, Inc. TRADEMARKS: LASERLINE, Oki Electric Industry Co., Ltd.; LaserControl, Insight Development Corp.

...the OKIDATA LASER drives them home.



Crawford, McFarland & Heckler Attorneys at Law

2800 Samson Street ☐ Philadelphia, PA 19132 ☐ (215) 555-7284

Jan 2, 1985 Initial idea; first attempts at printing story.

Jan 22 - Redefined formula for dried fruit. Shopped for food processing plant.

Feb 15 - Researched market - no direct competition.

Feb 21 - Registered letter to self; contents: sketches, specs, bids, names, formulas.

Mar 27- Sent samples to Food & Drug Admin. for tests.

Sep 19, 1986 Safety tests initiated; insurance research started.

Sep 26 - Registered name and trademark for product: "SMART SNACKS."

Oct 11 - Financial backing obtained.

Oct 26 - Safety test results back; package design approved.

Nov 17 - Market reseach results back; insurance coverage obtained.

Dec 9 - Contacted pateat attorney; met with three ad agencies

Dec 11 - Delivered samples & documentation to attorney.

Dec 27 - Presentation to Board of Examiners and Offices of Patents.

U.S. Patent Office
1840 Pennsylvania Avenue
Washington, D.C. 20301

September 7, 1987

Dear Sirs,

With the attached notes and drawings as background, I am officially seeking a patent for the manufacture, sale and licensing of the product "SMART SNACKS," *the edible "books" that help kids grow intellectually and physically.*

"SMART SNACKS" *are children's stories printed on pages of dried fruit, so a child can eat one after he or she reads one.*

My client conceived, developed and tested this unique product between January 2, 1985 and December 26, 1986. The chronological details are contained elsewhere in this document. The timeline for the process is presented here:

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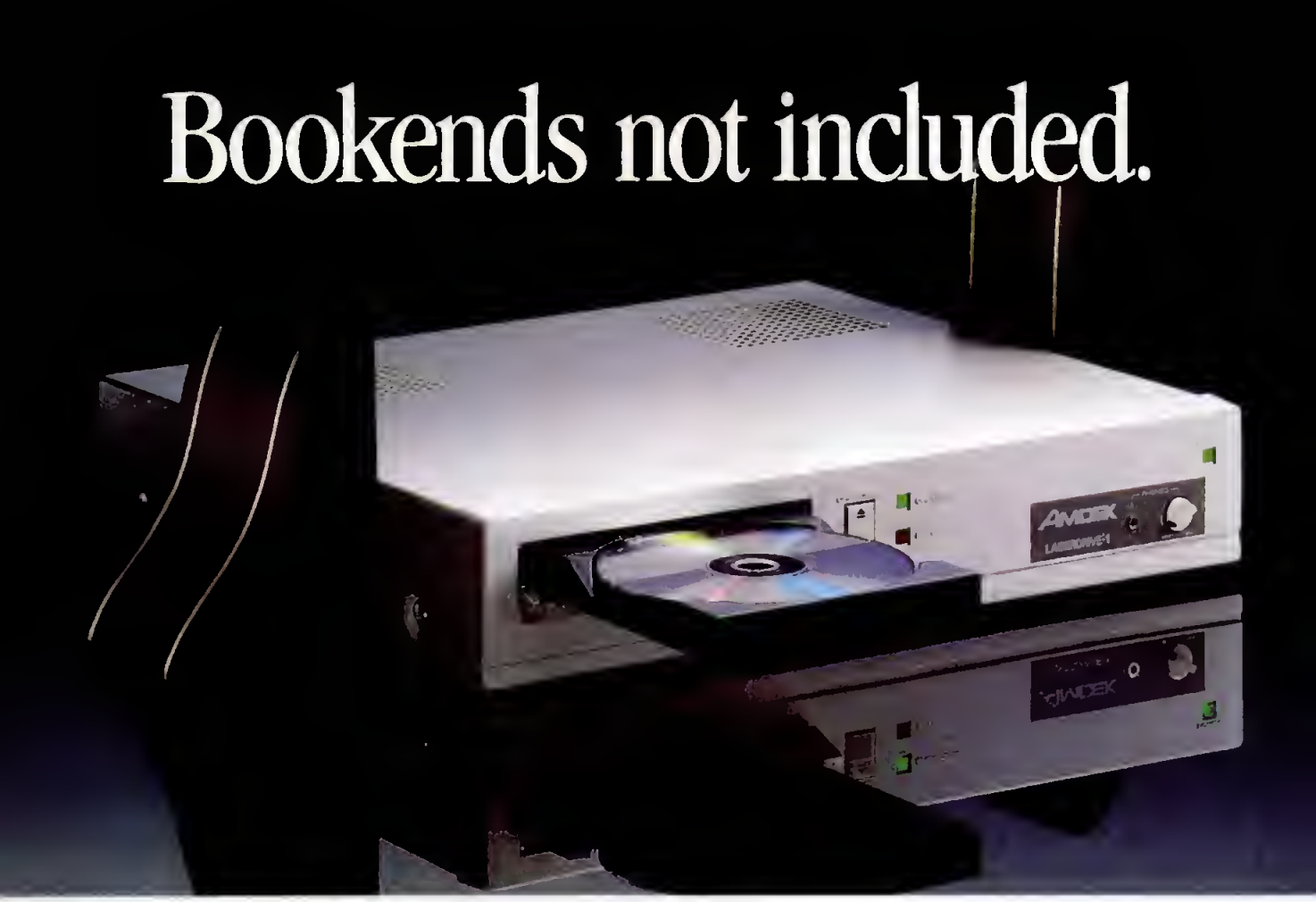

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CIRCLE 102 ON READER SERVICE CARD

PRESENTATION-SIZE MONITORS GRADUATE TO EGA

In this age of microcomputer miniaturization, when machines such as IBM's Personal System/2 are promising ever-smaller PCs for ever-larger tasks (and budgets), EGA displays the size of a refrigerator might not be as retrograde as you may think. Light up a 19-inch, high-resolution display, and the glow you see won't just be on the luminescent screen. It'll be on the faces of power users, architects and engineers who have a penchant for detail, and producers Hollywood hasn't yet discovered who want the large displays for PC presentations and group demos.

For these folks and a multitude of others, getting the big picture means seeing things clearly, communicating better, and turning the image on your PC display into something that shows up across an auditorium. Creating such images is the job of

It ain't Cinerama. But Aydin Controls, Conrac, Electrohome, Epsilon Graphics, Intecolor, and Microvitec can showcase your presentations on a big screen.

19-Inch EGA Monitors: Summary of Features

(Products listed in ascending price order)

	MegeTREND Intecolor	1019 Definitioe Autosync Microvitec Inc.	EG-19 Enhanced Graphics Display Epsilon Graphics Corp.	Patriet Enhancer Aydin Controls	Veri-Scee ECM1910 Electrohome Ltd.	Model 7250 Auto-Trak Conrac Corp.
List price	$1,635/$1,895	$2,195	$2,695	$2,700	$2,795	$2,995
Tilt/swivel stnnd	Included	Included	$90	$175	$106	$150
Imege size (inches)	13 × 10	14 × 10¼*	15 × 10¾	14¼ × 10	13¾ × 10†	15½ × 11½
Cnbin length (inchns)	48	72	48‡	60	36§	72
Resolution (pixels)	640	1,024	1,024	700	1,024	1,024
Bendwidth (MHz)	32	40	50	25	35	40
Dot pitch (mm)	0.47/0.31	0 31	0.31	0.31	0.31	0.31
CASE DIMENSIONS (inches)						
Hnight	19½	17½	17	19	17¼	14
Width	19½	18½	19	19½	19	19
Dnpth	20	20	20	19½	20	22
COMPATIBILITY						
COA	●	●	○‖	●	●	●
EGA	●	●	●	●	●	●
VGA	○	●	○	○	●	●
PGC	○	●	○	○	●	●
INPUTS						
RGB	●	●	●	●	●	●
Compnsitn	○	Optional	○	○	○	●
Snpnrnte sync	○	○	●#	○	○	●
Annlog	○	●	●#	○	●	●
OUTPUTS						
RGB	●	○	●**	○	○	○
Compnsite	○	○	○	○	○	○
CONTROLS						
Brightnnss	●	●	●	○	●	●
Conirast	●	●	●	●	●	●
Half-letensity	○	○	○	○	○	○
Color	○	○	○	○	○	○
Horiz. position	○	●	○	○	●	●††
Vnrt. position	○	●	○	○	●	○
Horiz. size	○	●	○	○	●	○
Vnrt. size	○	●	○	○	●	○
Other	Degauss	Degauss	Degauss	Degauss	Degauss, auto/ overscan	Degauss
MISCELLANEOUS						
Monochromn switchnble	○	○	○	○	○	●
Text-color selectebie	○	○	○	○	○	○
Drigie	U.S.	U.K.	Japan	U.S.	Japan	U.S.

●—Yes ○—No

* User adjustable in each operating mode.

† Two-position overscan control; listed size is without overscan.

‡ Special configuration and cable lengths available from manufacturer.

§ Five-foot cable optional, $38.

‖ CGA works in text mode only; factory can configure for CGA-only operation.

BNC connectors for RGB analog inputs on monitor.

** Analog RGB loop-through available on monitor; TTL RGB loop-through on adapter box.

†† New feature; not available on evaluation unit.

the big-screen EGA monitor—a new generation of PC displays capable of resolutions of 640 by 350 and beyond. They are available from Aydin Controls, Conrac, Electrohome, Epsilon Graphics, Intecolor, and Microvitec at list prices ranging from $1,895 for Intecolor's MegaTREND to $2,995 for the Conrac.

Whether measured in inches, pounds, or price, the current crop of hyperpituitary Enhanced Graphics Adapter–compatible displays represents the latest twist in PC-based graphics. These 19-inch monitors are helping to push the work of the personal computer in front of new audiences and into new applications.

The makers of these big displays have earmarked their products for two primary applications: computer-aided design and presentation graphics. Along the way, the giant displays are being used to advantage in mapmaking, desktop publishing, and even general-purpose computing. While CAD on the PC was once at best a scratch pad or sometimes the only computerization that small, tightly budgeted engineering organizations could afford, today's PCs with fast microprocessors and these big screens are giving dedicated workstations strong competition.

CAD is a major challenge for computer displays. As with any form of engineering, most of CAD is detail work: taking a concept and fleshing out minutiae to make it work. The more of those details that the engineer can see with one glance at the screen, the better and faster he can work. The bigger the screen, the better those details can be seen. The 19-inch EGA monitors, however, deliver the resolution you're accustomed to seeing on a comparable 14-inch display to a bigger screen. The image is bigger but the resolution is no better and, when spread across those extra inches, may not be well suited to detailed CAD applications. Of course, the resolution is limited more by the video standard used (CGA, EGA, VGA, and so on) than by the electrical and mechanical elements of the monitor itself. Many of the monitors we reviewed are capable of delivering 1,000 pixels—better performance than the standard IBM video adapters afford.

The true calling of these big screens is presentations and group demos. Hence, if your application calls for high res, you may want to investigate the 14-inch Nec MultiSync, which lists at $899, or the IBM Enhanced Color Display at $849 instead (see "Behind the Screens: EGA and Multiscan Monitors," *PC Magazine*, Volume 6 Number 6).

Where personal computer graphics once seemed to be a personal matter, big-screen monitors make them public. Presentation graphics redefine the personal computer as an interpersonal communications device. It conveys concepts and ideas to an audience, and the more people it can reach, the more efficient the flow of information. The big screen makes the message visible farther away and to a larger group.

■ Whether measured in inches, pounds, or price, the current crop of hyperpituitary EGA-compatible displays represents the latest twist in PC-based graphics.

In addition, big-screen monitors are pleasing to aging boomers and other folks whose failing eyesight condems them to peer through the world with spectacles fashioned from old bathyscaphe portholes. The big screens are easier to read, easier on the eyes, and help forestall the inevitable onslaught of squint lines.

YESTERDAY'S TECHNOLOGY TODAY Big-screen monitors are nothing new. They've been professional products for years, happily ensconced in television studios, medical-imaging systems, and high-powered engineering workstations. The difference between today's big-screen PC displays and their forerunners is only in the interface.

Older big-screen sets used a variety of industry-standard and proprietary signals, none of which were directly PC compatible. The six sets seen here are meant to plug directly into your PC using the EGA standard resolution of 640 by 350 or, with some models, any of the current PC video standards up to the PS/2's VGA (Video Graphics Array) of 640 by 480.

All of the screens we reviewed, except the Epsilon Graphics Corp. EG-19, dip down to CGA (640 by 200 black and white, 320 by 200 four-color) compatibility. Three—Conrac's 7250 Auto-Trak, Electrohome's Vari-Scan ECM1910, and Microvitec's 1019 Definition Autosync—stretch their compatibility to include both VGA and the PGC (Professional Graphics Controller) standards by offering analog and TTL video inputs, as well as having the ability to synchronize with horizontal scanning frequencies of 30 KHz and beyond.

Behind the big screen, these monitors are very similar to their smaller siblings—the traditional 12- and 14-inch monitors on desktops worldwide. Consequently, once you decide to buy a big picture, your primary concern will be the same as with any other computer display: how it looks to your own eyes. Several design details influence the quality of the image that you see.

The tube matrix—essentially the unlit background color of the screen—is one of the factors that determines screen contrast and how well colors stand out. A dark matrix can make on-screen hues look brighter and snappier—and even easier to read.

Glare reduces contrast, washing out the screen image. Too much glare can lead to eyestrain and headaches. Antiglare screen treatments help any display look good, even under adverse lighting conditions.

In the deficit column, however, most screen antiglare treatments result in a slight "fuzzying" of the image. At the typical viewing distances at which these large screens are used, however, a slight loss in sharpness is likely to be imperceptible.

The limiting factor in the resolution of any color display is the dot pitch—the distance between the centers of the perforations in the shadow mask inside the cathode ray tube (CRT) that keeps the red, green, and blue colors separate. The finer the dot pitch, the sharper the image and the finer the detail that can be displayed.

In a 19-inch display with a horizontal image width of about 12 inches (640 pix-

els), a resolution of at least .50 millimeters is required, although larger dot pitches may make images acceptable to some people and applications. In comparison, most 13-inch EGA monitors use .31- or .28-millimeter dot pitches. Softening sharp images can take the rough edges off sketches and drawings used in presentation graphics.

Although all of these monitors have a nominal screen size of 19 inches, measured diagonally, the actual size of their displayed images varies considerably. Because image consistency is tougher to achieve in the corners of the screen, to keep straight lines straight some monitors incorporate some degree of underscan, yielding an image smaller than the tube actually allows.

In fact, with some monitors, the size of the on-screen image may vary with the interface that's used. For instance, with the Intecolor MegaTREND the CGA image is several inches smaller than its EGA image.

TAKING CONTROL A few monitors give you direct control over image size. Most, however, put these size controls inside the set, a place where casual or inexperienced users should not venture without a 10-foot insulated pole and rubber suit.

The voltage inside color monitors, as with color television sets, is high enough to be lethal. Dangerous residual voltages may be present for quite some time after a set is turned off and unplugged. The warnings that advise access be limited to service personnel should be heeded.

Those who like to personalize the picture on their displays will find in these monitors a wealth of controls at their fingertips, including intimate control of image size and positioning. Some sets also let you select the interface standard to be used. Others figure out what signals your computer is sending and adjust themselves accordingly.

All monitors except the Aydin feature self-explanatory controls common even to television sets: brightness and contrast. In addition, all of these large-screen displays have manual degaussing push buttons.

Because the electron beam that lights the image on the tube is guided magnetically, stray magnetic fields can lead it astray. The tube itself can build up a residual magnetic field. Stray magnetism results in odd blotches of color and distorted images on the screen. The degausser eliminates residual magnetism. Although most of these monitors have automatic degaussers that operate momentarily when the set is turned on, the manual switch lets you clear up screen problems without shutting down the display.

STELLAR PERFORMERS While monitor makers have shrunk the boxes that house 13- or 14-inch EGA displays, the big screens we reviewed seem to have a disproportionate amount of depth at the rear end. Higher-deflection tubes are the norm in small, monochrome CRTs and in some color designs. The 19-inch beasts in these big sets, however, retain the modest deflection angles (typically 90 degrees) that ensure precision geometry in their on-screen images.

■ These big screens can be demanding when it comes to finding them a home: You're not going to want to plop one down atop your PC.

Lighting up that whole image area also requires more power, which requires heftier electronics. Consequently the largest of the breed, Conrac's 7250, will dominate any desk. Even the smaller megascreens may be more than most typical work surfaces can handle.

These big screens can be demanding when it comes to finding them a home: You're not going to want to plop one down atop your PC. Such an installation will likely resemble a teetering balanced rock in the Painted Desert and will inspire little confidence in its longevity.

To make the mass more manageable, some manufacturers include tilt-swivel bases with their displays, either building it into the base (Intecolor), including it free (Microvitec), or making it an extra-cost option ($175 from Aydin and $106 from Electrohome).

Of course, a tilt-swivel base does nothing to make the monitor itself smaller or lighter. You may want to give your pick of these monitors its own, separate desk or table to stand on. These monitors weigh 50 to 80 pounds—enough to put a wobble in a typing stand.

The greater power that these big tubes require also means a larger drain on your utility line. At 100 to 150 watts, they require many times the current of more modest monitors. What doesn't go to the screen wafts out the top and back of the sets in waves of heat. You won't want to use one of these displays in a small room that lacks air conditioning, unless it happens to be an igloo and you want to hasten the spring thaw.

Nor will you want to sit inches away from one of these while you work (as most people do with 14-inch displays). One reason is that you'll be looking more at dots than a complete image. You need enough distance to make the whole screen visible in a glance.

Bigger tubes require higher voltages to make them work, and these higher voltages can result in x-radiation. X rays were a concern in the 1970s, but no more. A monitor in proper alignment and good condition is not cause for concern. The government strictly regulates the amount of X rays that can be emitted by these monitors (as it does with color television sets).

ADVANTAGE OR ANACHRONISM? The biggest question you have to answer is whether you need a big display at all. Those extra 5 inches will cost you about $1,500 more than a conventional color display. That's a big price to pay, even though the actual display area just about doubles when you move up from 14- to 19-inch monitors.

Displays with only EGA compatibility may prove to be of doubtful value considering the emergence of the new VGA display standard. Simply put, VGA is visibly superior. Buy EGA-only, and you could be stuck with an eyesore 2 years hence. Among the units we reviewed, the Conrac, Electrohome and Microvitec were VGA compatible.

Nineteen-inch EGA monitors deliver an image area that is nearly double that of their 14-inch siblings. But these displays are not workstations in the tradition of computer-aided design. Their 640 by 350 resolution makes them better suited for presentations in boardrooms than for CAD applications.

Moreover, EGA-only displays are monsters in more ways than one. Not just huge, they are display technology run wild. While making things bigger, they ignore the need for increased detail demanded by CAD and desktop publishing. You can see the rough edges of the EGA standard much more glaringly on a big CRT. Smooth lines become jaggy with increasing magnification.

■ These big EGA displays earn their engineering keep only when their colorful nature comes into play.

The impetus in display system design for CAD and desktop publishing is toward ever-higher resolution, with or without an increase in screen size. For these applications, the 640 by 350 pixel limit of the EGA is kid stuff. Engineers and graphic designers want 1,000, 2,000 or more pixels across their screens.

Those who need resolution more than color will find that a big monochrome screen coupled with a proprietary high-resolution controller is a better buy at a similar price. These big EGA displays earn their engineering keep only when their colorful nature comes into play, such as when looking at several layers of circuit board or color-coded layers of CAD drawings, or breaking complex assemblies into their constituent parts for easier scrutiny.

Presentation graphics demand color to achieve the greatest impact. Although a big-screen EGA display rates as an expensive solution, motivating one additional sale of your company's product may more than pay for the initial investment.

Personally, I prefer to work with a big screen halfway across the room. My headaches are fewer and my eyesight doesn't seem to dim as much as the day drags along. If a big screen helps prevent my vision from deteriorating further, it may be worth any price.

AYDIN CONTROLS

Patriot Enhancer

If all the controls on your color television confuse you, you'll love Aydin Controls' Patriot Enhancer. At a list price of $2,700, it gives you exactly one control to worry about—a large front-panel disk labeled "Contrast." Everything else—except for the power on/off switch and manual degausser—is preset and out of your reach and worry. It even automatically switches between its CGA- and EGA-compatible modes with a minimum of rigmarole.

With a front panel that resembles the protruding underbite of stubborn English bulldog, the Patriot Enhancer gives the same stalwart first impression. Physically, the first impression is misleading because the Patriot Enhancer case is not extraordinarily large: it measures 19 by 19½ by 19½ inches (HWD). At about 8 inches be-

PC MAGAZINE FACT FILE

Patriot Enhancer
Aydin Controls
414 Commerce Dr.
Fort Washington, PA 19034
(215) 542-7800
List Price: $2,700 (with tilt-swivel base, $2,875).
Requires: CGA or EGA adapter.
In Short: A monitor for the minimalist that features one user control, good color, but inadequate brilliance for bright environments.

CIRCLE 699 ON READER SERVICE CARD

Photographs: Thom O'Connor

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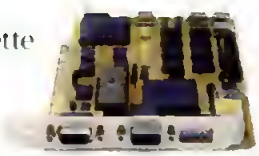

But this isn't just a BIOS level VGA card. VEGA VGA offers complete software compatibility for all VGA programs. And that's not all.

VEGA VGA is backwards compatible, working with your favorite software programs for EGA, CGA, MDA and Hercules. Guaranteed.

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And due to our innovative design, VEGA VGA supports both analog and digital monitors. Which means it will work with the monitor you're currently using.

And it works up to 400% faster than an EGA card.

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CIRCLE 336 ON READER SERVICE CARD

Aydin's Putriot Enhancer displays all colors of the IBM palette exactly as they should be, although the monitor is not terribly bright. The brightness factor should cause no difficulty in a normally lit office but could make for difficult viewing in bright environments.

hind the front of the screen it stoops to about 15 inches in height. Overall, it occupies about the same desk space as do most other monitors its size. A tilt-swivel base is optionally available, adding $175 to the list price.

The whole of the case is plastic, finished mostly in office-equipment light beige. Surrounding the screen but not quite filling the front of the set is a gray bezel with straight edges and round corners.

The rear of the set features exactly two connectors: a male DB-9 for video input and a power cord jack. A meter-long cable is supplied for plugging into standard video adapters.

At the top rear of the towering front 8 inches of the set are two small, almost-hidden switches. On the right is a rocker that controls monitor power. At left is a momentary switch that operates the manual-only degausser. The front panel contrast control and large amber power-on indicator complete the array of user adjustments.

In both its EGA and CGA modes, the active image area on the Patriot Enhancer screen measures the same: 14¼ by 10½ inches (17¼ inches diagonally). The aspect ratio of the screen was just over (almost imperceptibly so) the expected IBM specification of 1.33. No provision for user adjustment of these parameters is provided externally.

The tube, an 18½-inch diagonal of which is visible, uses a very dark matrix and antiglare treatment to increase contrast. Consequently, with its contrast control set nearly in its maximum (clockwise) position, the Patriot Enhancer gives a very good image: sharp (0.31 millimeter dot pitch), saturated, and with all the colors of the standard IBM palette exactly right.

NOT BRIGHT ENOUGH One word that doesn't fit is "bright." With the lonely contrast control twisted all the way up, the image glows brightly enough for viewing in a normally lit office. If the environment is itself bright, however, the Patriot Enhancer does not have enough oomph for rising above the background. .

■ Aydin Controls' Patriot Enhancer will give your EGA graphics a colorful, bold new look with a minimum of fuss, bother, and worry.

Another deficiency in the display appears only in CGA mode. While EGA characters are well defined, CGA text may be too much so. Individual scan lines are overly apparent, giving each character an obviously stratified effect. Otherwise, the display showed no bad habits, artifacts, or other deficiencies.

A true patriot, Aydin makes the Patriot Enhancer in the U.S. and has been granted FCC Class A certification for the set. Although the Patriot Enhancer would itself be enhanced with more brightness and perhaps just a tad more user control, even as it stands it will give your EGA graphics a colorful, bold new look with a minimum of fuss, bother, and worry.

Benchmark Tests: 19-Inch EGA Monitors

The Conrac Model 7250 Auto-Trak proved to be the most glare resistant on each portion of the PC Labs Monitor Glare Resistance benchmark test. It appears to have a darker screen coating than the other five monitors, and its 1⅛-inch screen bezel helps lower reflected light in the overhead (30-degree) test.

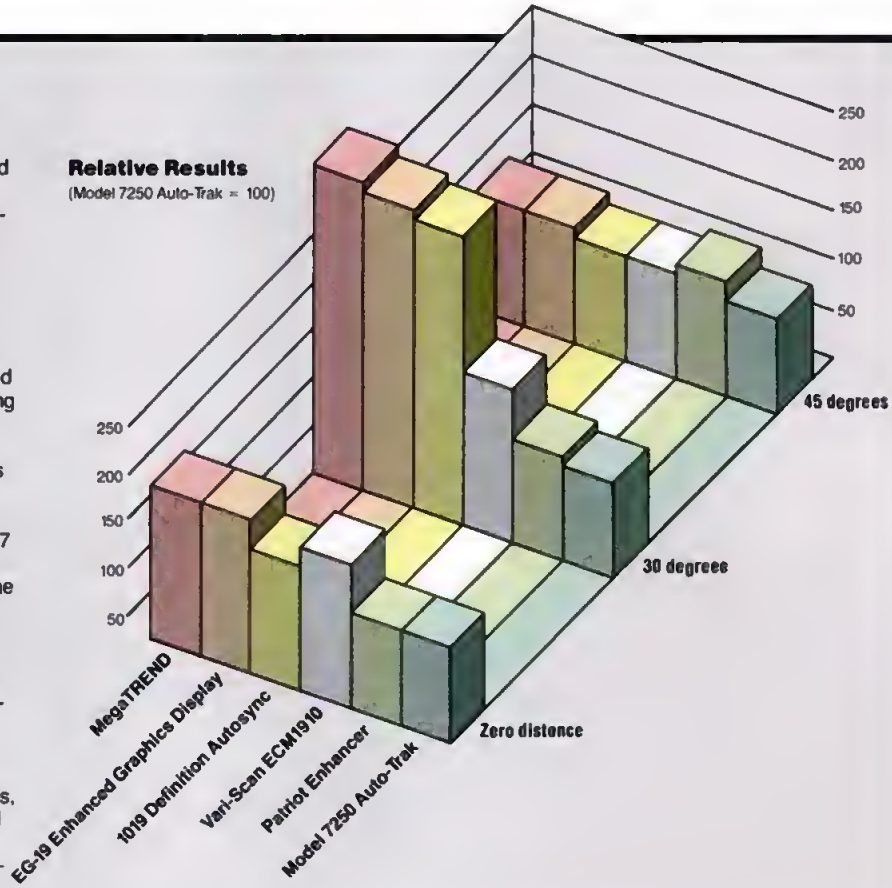
At 60 and 90 degrees, light sources were so direct that no monitor was unaffected and the readings were uniformly high—indicating poor resistance to glare. The Model 7250, with readings of 67 percent at 90 degrees and 62 percent at 60 degrees, nevertheless performed better than the other monitors tested. The Aydin Patriot Enhancer had readings of 69 percent at 90 degrees and 67 percent at 60 degrees. The 1019 Definition Autosync by Microvitec and the Electrohome Van-Scan ECM1910 performed identically with readings of 71 percent at 90 degrees and 66 percent at 60 degrees. The Epsilon EG-19 Enhanced Graphics Display and the Intecolor MegaTREND each posted 70 percent readings at 60 degrees and at 90 degrees had readings of 74 percent and 73 percent, respectively.

Readings were more varied at 45 degrees, however. Registering 56 percent, the Model 7250 was somewhat more glare resistant than the Electrohome Van-Scan, which registered 60 percent, and considerably more glare resistant than the Epsilon EG-19 and MegaTREND, which registered 67 and 69 percent, respectively. The 1019 Definition Autosync had a 64 percent reading, and the Aydin Patriot had a 65 percent reading.

The greatest difference in readings occurred at 30 degrees, where the light is similar to that produced by overhead fixtures. The Model 7250 scored 11 percent, compared with the MegaTREND, which registered more than three times the glare with a reading of 35 percent. The Electrohome Vari-Scan had a reading of 18 percent. Readings on the 1019 Definition Autosync and the Epsilon EG-19 were 33 percent and 34 percent, respectively.

There was less variation in the readings at 0 distance, but, again, the Model 7250 performed best with a reading of 10.5 percent, compared with the Epsilon EG-19 with a reading of 16.6 percent, a difference of approximately 60 percent.

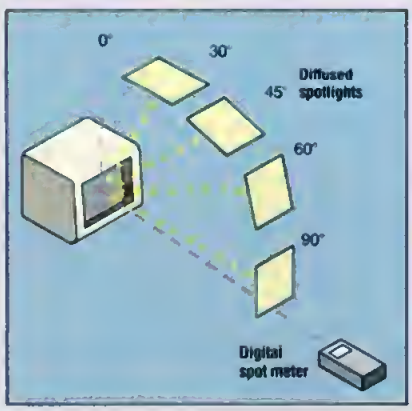
Because of the Conrac Model 7250's superior performance and because of the inherent unfairness of using the IBM EGA monitor (which, with its much smaller surface, reflects far less light than the 19-inch models), the Model 7250 was used to normalize the test results for the three-dimensional graph.



Monitor Glare Resistance

(Actual light readings given in percent of reflected light)

	Zero distance	30 degrees	45 degrees
MegaTREND	16.5	35	69
EG-19 Enhanced Graphics Display	16.6	34	67
1019 Definition Autosync	13.8	33	64
Vari-Scan ECM1910	16.0	18	60
Patriot Enhancer	11.0	12	65
Model 7250 Auto-Trak	10.5	11	56



The **Monitor Glare Resistance** benchmark test simulates different lighting conditions by placing diffused spotlights vertically at 30-, 45-, 60-, and 90-degree angles to the screen. The light positioned at 30 degrees is meant to simulate overhead light, the 45- and 60-degree angles can be compared to a desk lamp, and the 90-degree lamp simulates direct light, such as that coming from a window.

The light reflected from the screen is measured with a spotlight meter that produces readings between 0 percent and 100 percent (for reference, a matte black card gives a 4 percent reading, and a mirrored surface registers 96 percent). A reflecting densitometer was also used to take a reading of the screen surface. This device is similar to a spot meter but is placed directly on the surface of the screen and uses an internal light source to measure the amount of reflected light.

CONRAC CORP.

Model 7250 Auto-Trak

In the Model 7250 Auto-Trak, a screen that lists at $2,995, Conrac Corp. gives you more: more compatibilities—from CGA to EGA to PGC to VGA—and more mass. In fact, the styling of the 7250 resembles one of the blocks used in building the Great Pyramid of Cheops at Giza.

Roughly rectangular in outline, 14 by 19 by 22 inches (HWD), the rear half is inset almost imperceptibly, and the case subtly broadens toward the base, giving the impression of even more mass. The whole thing sits atop four plastic feet almost an inch high, allowing air to circulate up through the louvers that cover most of the base and about half the top of the case. Made in America, the 7250 has been FCC Class A certified.

The screen is recessed almost 2 inches behind a sculptured bezel, the vertical elements of which spread from under an inch to an inch-and-a-half at the bottom. At the bottom of the left side of the bezel is a small green LED that indicates when power is on. At right are three user controls: knobs for brightness and contrast, and push button for the degausser. Pulling out the brightness control switches the 7250 to monochrome mode, making the screen green (this color is not user selectable).

The rear panel is the home of a number of little-used controls that allow you to adjust the compatibility of the 7250. Slide switches select between analog or TTL inputs, 16- or 64-color operation, and IBM compatibility. The input connector is a standard female DB-9, and Conrac supplies a 1-meter cable terminating in a male DB-9 for plugging into your PC. Although the connector is standard, the 7250 provides several signal options in addition to standard RGB. This jack also supports composite and separated sync.

A socket is provided for the detachable power cable. Inexplicably, the power switch is hidden on the rear panel, too. It's a small rocker switch that's nearly inaccessible.

In many ways, the image on the first of what eventually became two Conrac 7250's that we received for evaluation proved to be a genuine jewel. Its colors stood out bright and saturated against a dark black matrix. The direct-etch screen treatment and the deep bezel nearly eliminated contrast-robbing glare. Colors were a perfect match for the IBM standard (purer than an ordinary IBM display). Contrast range was superb, with gray levels easily sorted out. All characters were chiseled sharp courtesy of the fine 0.31-millimeter dot pitch of the CRT.

In CGA mode, the active image area is small, measuring only 16 inches diagonally (a 12½- by 9½-inch rectangle), but the EGA image nearly filled the screen at 15½ by 11½ inches. VGA performance could not be tested because Conrac's VGA cable was not available at the time, although company representatives said one was being developed and should be ready soon. We tried using a cable from Electrohome, but it didn't work. That's not surprising, though: implementing VGA requires get-

Colors on Conrac's Model 7250 Auto-Trak stand out bright and saturated against a dark black matrix and match the IBM standard. Contrast range is superb.

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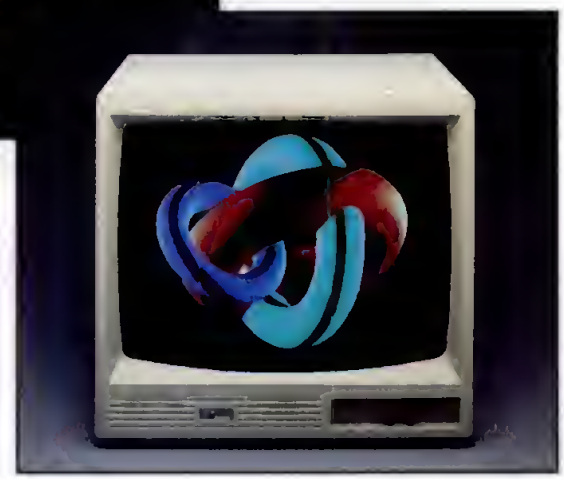

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LOOKS ARE DECEIVING

Wouldn't it be great if you could use your 19-inch TV set as a monitor, or vice versa?

Big, 19-inch display screens look an awful lot like television sets. Wouldn't it be great to make them do double duty—business graphics and home entertainment—from one tax-deductible purchase?

That's a compelling idea, but we can't recommend it. In most cases buying a television and a big-screen monitor individually may be cheaper and you wouldn't want to deduct your personal expenses from your taxes anyway. It's against the law.

Although they may look alike, these 19-inch monitors and like-sized televisions have little in common. Turning one into the other is more a job for an idle engineer or tycoon than for anyone of ordinary ways and means.

The fundamental difference between televisions and big-screen monitors is signal. Both EGA and CGA displays deal with baseband digital signals in which the three primary colors—red, green, and blue—have been separated and are sent to the set individually. Televisions use modulated analog signals in which colors are combined together and mixed with synchronizing signals and a carrier wave.

Computer monitor signals go almost directly to the electronics that drive its display tube. The television uses a tuner to lock in on a given television channel, detect the video component of the television signal, then convert it down to a baseband analog signal. Finally the television separates the colors and sends the separate signals to the display tube.

Adding a television tuner to one of these computer monitors won't work, nor will plugging one into the video output of a VCR. The output of consumer-quality tuners and VCRs is a signal called "composite video"—an analog signal that combines all three primary colors and is incompatible with the discrete digital RGB inputs these big-screen monitors prefer. (A few smaller multiscanning computer displays do have composite video inputs that will accept the output of most tuners and VCRs, however.)

If you want to go in the other direction and use your television as a computer display, you may have some hope. For instance, you can get a rather unsatisfactory 40-column image on your television set by attaching a modulator to your CGA board.

Better yet, a number of television sets have RGB inputs that will accept the CGA-compatible signals from your PC. (EGA compatibility is more difficult to find because the EGA standard specifies a horizontal frequency quite different from that used by normal televisions.)

Should you elect to go in this direction, hurry. The number of computer-compatible monitors appears to be dwindling. When we visited video dealers, we were given a pair of explanations for the decline. Interest in home (as opposed to business) computers is waning, we were told, so the demand for these combination sets is similarly shrinking. In addition, the value of the dollar in relation to the yen also has fallen, making imported televisions more expensive. To keep prices in the range that consumers are willing to pay, manufacturers have eliminated frills in their sets—computer-compatibility among them.

The remaining computer-compatible televisions tend to be top-of-the-line units that can quickly drain your purse. For instance, Mitsubishi's CS-2669R, a 26-inch television with CGA-compatible RGB inputs, lists for about $1,100. An astounding 35-inch direct-viewing model costs roughly three times as much.

Our advice: don't compromise. Buy a big-screen monitor for its sharp EGA image. If you want television compatibility, buy a television set. If you want both, buy both—in two separate boxes.

—Winn L. Rosch

ting a signal back from the monitor, and different manufacturers may implement this differently.

BIG SHAKE-UP Switching modes shook up the display severely, but after a click of a relay the image settled down in less than a couple of seconds.

According to Conrac, the image size for each mode (CGA, EGA, PGC, and VGA) is independently adjustable inside the 7250, though the high voltages present here may deter you from venturing near these controls.

The aspect ratio of both units was just a few percent oversquare, taller than the 1.33 of the IBM standard. Paint a border around the screen in CGA mode, and the color just touches the top of the screen bezel but leaves a half-inch gap of black on either side of the active image.

Otherwise, screen geometry was right on. Straight lines were ruler straight, including all of the edges of the active image area.

The first unit received for evaluation proved irksome, however. When asked to display a border in 80-column CGA mode, it floated the border color above the image and removed the border color from the active display area. In other words, when a white background with a blue border was selected, the set displayed a blue bar above a yellow background.

Inexplicably, in 40-column mode the border was properly drawn. According to Conrac, changing a jumper inside the set avoids this problem, and a second display delivered by the company worked flawlessly.

The initial evaluation unit also demonstrated a strange quirk: a glitch that traveled through the image every five or ten minutes, shaking things up ever so slightly, then immediately calming down. It was the sort of quiver normally associated with power line problems, but it was still evident even when the set was powered from

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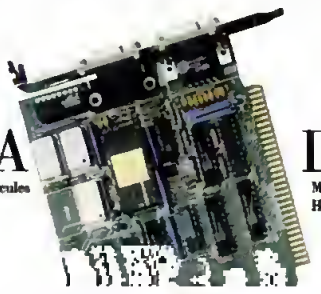

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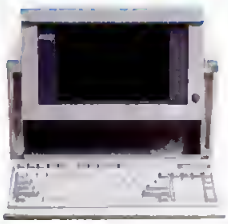

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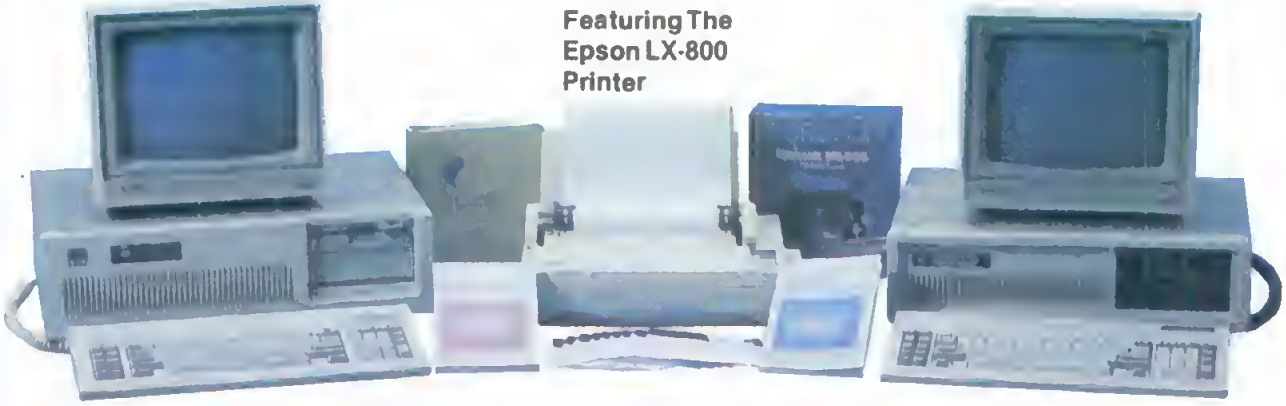

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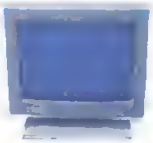

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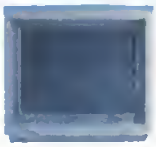

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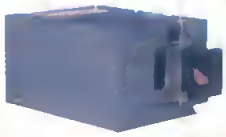

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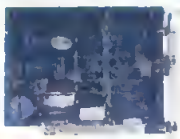

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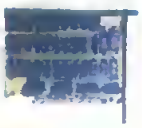

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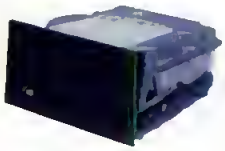

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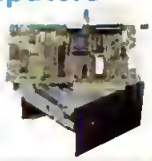

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To prove the ailments cited above were endemic only to the evaluation model, Conrac sent us a second 7250. Indeed, the glitch was gone, the CGA 80-column border worked, and CGA image size filled the screen. Unfortunately, its highlighted colors were yellowed because of a lack of blue, its black level seemed unusually high (illuminating supposedly black backgrounds at all but the highest contrast settings), and characters bloomed badly when brightness was increased near the top of its range. Fiddling with controls yielded the same top-notch image as the first unit, but we were sorely disappointed by the inconsistency between the two monitors.

Subjectively, when fiddled with properly, the 7250 had the best image of any displays reviewed here. Add that quality to its compatible-with-nearly-anything multiscan abilities, and it could rate as an excellent choice for those with room to spare if Conrac can put the best qualities of the two evaluation units together.

Electrohome's Vari-Scan ECM1910 displays a palette of bright, well-saturated colors that match the official IBM spectrum, including brown.

ELECTROHOME LTD.

Vari-Scan ECM1910

The Electrohome Vari-Scan ECM1910 looks like a normal-size monitor that just had a growth spurt. More than just an inflated EGA display, this screen, which lists at $2,795, has both sufficient bandwidth and the analog inputs needed to function under IBM's new VGA standard; it also has enough controls to let you either take full advantage of its 19-inch screen or restrict its image to a small—but geometrically perfect—area of the tube.

The top of its pale gray-beige case, which measures 17¼ by 19 by 20 inches (HWD) in maximum extent, gradually slopes inward toward the rear, and the big screen, surrounded by a dark beige bezel, floats above a recessed baseplate molded into the case. A tilt-swivel base is optionally available (at $106).

The front of the display is very clean, with legends and a bright green power LED, but no visible controls. Brightness and contrast are adjusted by thumbwheels hidden under the bottom front edge of the screen, and the power switch is merely a plastic push button sculpted into the contour of the case itself. The two thumbwheel display controls are detented in their center position.

The masked size of the screen falls short of a full 19 inches diagonally by half an inch. In underscan mode, the screen image measures 13¾ by 10 inches (17½ inches diagonally), in either CGA or EGA operation. In the display's full overscan mode, the image more than fills the screen (15 by 11½ inches). As delivered, the display had an aspect ratio reading within a few percentage points of 1.33.

A second, slightly updated Vari-Scan ECM1910 was sent to us by Electrohome with a makeshift cable to demonstrate its

PC MAGAZINE FACT FILE

Vari-Scan ECM1910
Electrohome Ltd.
809 Wellington St. North
Kitchener, Ontario CD N2G 4J6
(519) 744-7111
List Price: $2,795; tili-swivel base, $106.
Requires: CGA, EGA, PGC, or VGA, cable (5-foot TTL analog cable, $38).
In Short: A big multiscan monitor that showed no inherent problems and produced bright, clear images straight from the box. A trouble-free choice with a wide variety of user controls.

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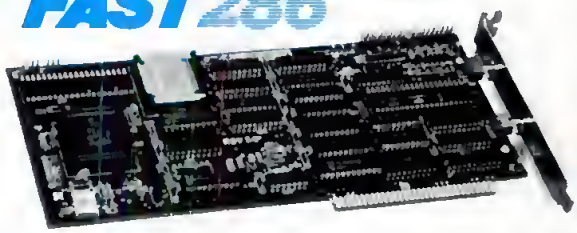

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VGA abilities. Its performance proved identical to the first. The VGA image size matched that of its CGA and EGA images. Conrac and Microvitec offer the only other displays with VGA compatibility.

MORE CONTROLS However, the size and shape of screen geometries is to some extent irrelevant once you consider the wealth of image controls on the rear panel of the Vari-Scan ECM1910 display. Two finger-adjustment controls govern horizontal and vertical image positioning. A push button allows you to select a full-screen image or an underscan mode, and a slide switch lets you select between analog or TTL inputs, each of which has its own female DB-9 connector. The monitor comes with a 3-foot connecting cable—analog or TTL. A 5-foot cable is optional at $38.

The rear panel also includes four sets of size and positioning controls, vertical and horizontal, that correspond to four preset modes, controlled automatically or manually through a push button. Also available on the rear panel is a manual degaussing switch and a power line fuse.

Performance proved extremely good, with high contrast despite the medium-gray matrix of the CRT. Helping the contrast along was the antiglare treatment of the screen. The bright and well-saturated colors perfectly matched the official IBM spectrum, including brown.

The .31-millimeter dot pitch of the CRT is more than adequate for EGA and higher resolutions. Consequently the characters are sharp; commendably, they do not enlarge inordinately (thereby making text look fuzzy) upon increasing screen brightness. The brightness range was not great, however, and the Vari-Scan ECM1910 screen washed out in brilliantly lit surroundings.

The only annoying habit exhibited by the Electrohome display was a slight "breathing" of the image when changing modes (for instance, from CGA to EGA). Over a period of a few seconds, the image would gradually grow or shrink, then finally stabilize.

FCC Class A rated and made in Japan, the Electrohome Vari-Scan ECM1910 rates as an excellent choice for top-quality large-screen graphics—one with growth potential in the VGA arena.

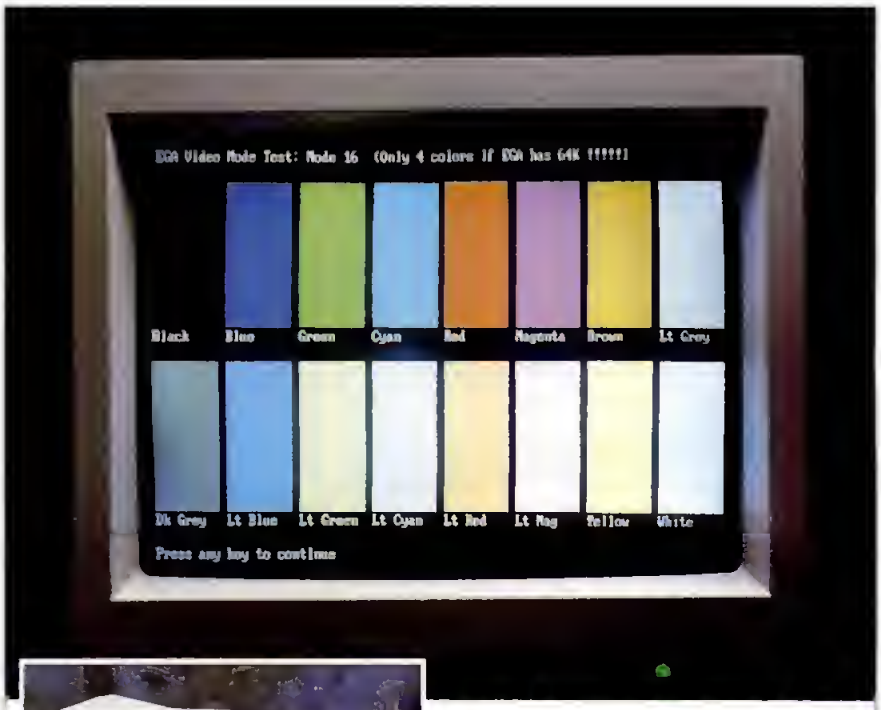
EPSILON GRAPHICS CORP.

EG-19 Enhanced Graphics Display

Unlike most EGA displays that acknowledge previous standards and run CGA software as if it weren't horribly dated and obsolete, Epsilon Graphics Corp.'s EG-19 Enhanced Graphics Display sticks solely with quality. This screen, listing at $2,695, won't run CGA graphics. That deficiency is understandable considering the unusual construction of the EG-19: it's a Mitsubishi C-3922K analog input RGB monitor that has been adapted for EGA compatibility with Epsilon's own circuitry in a small metal box. The little converter box does the necessary interfacing magic.

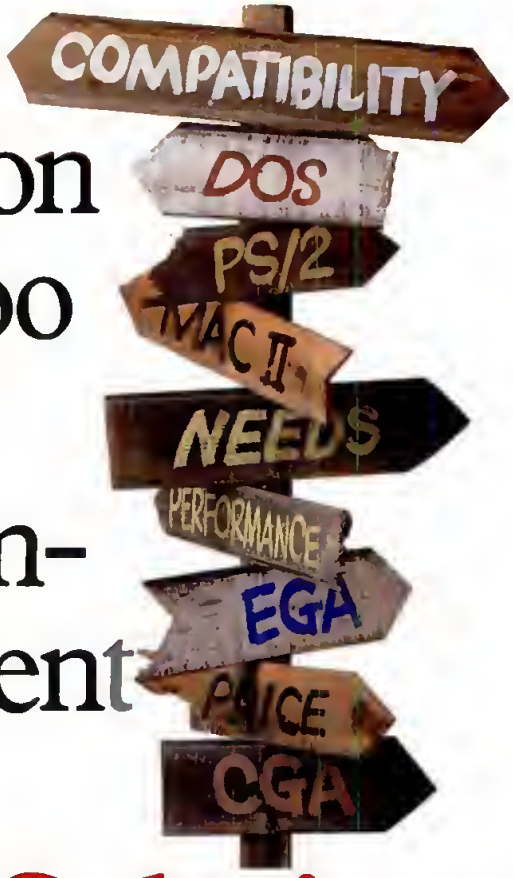
The Japanese-made Mitsubishi monitor is a good-looking if austere system. Although at 17 by 19 by 20 inches (HWD) it dimensionally rates as one of the smallest displays in this review, it has the appearance of being one of the most massive. From its large bezel it tapers only a little toward the rear, mostly a reduction in height. The bottom 2 inches of the set are recessed somewhat, resembling a built-in stand, and the whole thing sits on four ¾-inch-high feet. The entire monitor is cased in pale gray-beige plastic and has been FCC Class A certified.

All user controls are up front. These include brightness and contrast thumb-



When brightness and contrast controls are properly adjusted, Epsilon Graphics' monitor displays clear colors, although they do not accurately match the IBM spectrum, particularly at high intensity.

The Problem:



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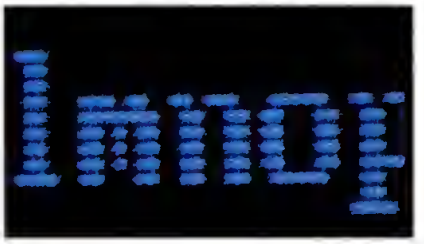
MONITOR RESOLUTION: THE BIG PICTURE

The on-screen performance—the sharpness of individual characters—of a monitor is determined by the dot pitch (distance between dots), dot shape, brightness, and purity of color they provide. We took a close-up look at the text-mode performance of Aydin's Patriot Enhancer, Conrac's Model 7250 Auto-Trak, Electrohome's Vari-Scan ECM1910, Epsilon's EG-19 Enhanced Graphics Display, Intecolor's MegaTREND, and the 1019 Definition Autosync by Microvitec. Each of the monitors uses .31 dot pitch tubes. However, those with brighter screens and the purest colors produced the sharpest image. Notice the clarity in the bright screens of the Definition and the MegaTREND and the somewhat fuzzy appearance of the blue-tone letters on the Patriot and the Vari-Scan. The performance you receive, however, may vary with the conditions. The close-ups in our test were taken in a black room. But the monitors perform according to the environment (light sources within the room and how far you sit from the screen). For instance, overhead tungsten lights typically lend a bluish look to the screen, while fluorescent lights produce pinkish tones.

Aydin Controls Patriot Enhancer



Conrac Model 7250 Auto-Track

Electrohome Vari-Scan ECM1910

Epsilon Graphics EG-19

Intecolor MegaTREND

Microvitec 1019 Definition Autosync

wheels recessed in a rectangular depression, a manual degaussing rocker switch, and an illuminated green power rocker switch.

The rear of the EG-19 features little except a jack for a power cord, a series of BNC jacks for the analog inputs, and a matching series of switches for 75-ohm terminating resistors for those inputs.

Of course, you'll never touch these jacks because the EGA connection is made through the 1- by 3- by 4-inch (HWD) Epsilon adapter box. It features both a male and female DB-9 connector, so it should be able to match any cord. This adapter gets its power from a small black wall-mount transformer through a detachable 6-foot cord. A tiny hole in the side of the case permits the adjustment of a horizontal centering control. The monitor itself draws 150 watts from your wall outlet.

The 20-inch tube of the EG-19 is masked down to just under 19½ inches diagonally, and the image area nearly fills it up, measuring nearly 15 by 10¾ inches (18½ diagonally). The screen features a medium greenish-gray matrix but is not antiglare treated.

STRAIGHT AS AN ARROW Geometrically the on-screen image is near perfect. Straight lines on the display are ruler

PC MAGAZINE

FACT FILE

EG-19 Enhanced Graphics Display
Epsilon Graphics Corp.
1370 E. Edinger Ave.
Santa Ana, CA 92705
(714) 558-1288
List Price: $2,695
Requires: EGA adapter.
In Short: A Mitsubishi RGB analog monitor adapter for EGA-only use with an interface box. The interface works, but the display demonstrated visual shortcomings.

CIRCLE 696 ON READER SERVICE CARD

straight, even at the edges of the image, although the curvature of the screen can make such lines appear to bend slightly (they don't however; it's just an optical illusion). The aspect ratio of the screen is just a fraction taller than the standard, but not objectionably so.

Characters were sharp and the colors clear on the screen when the brightness and contrast controls were properly adjusted. The colors were, however, inaccurate, particularly at high intensity where a lack of blue tones turned the whole spectrum of bright colors strongly yellowish.

Other image failings included a repeating shadow (ringing) that faded in from the left screen margin. In addition, the left edge of most characters in the leftmost column was usually cut off.

Increasing screen brightness caused a large amount of smear, blurring characters when the screen was used in a well-lit area. Increasing the contrast to more than two-thirds of the way up caused the red beam to shift perceptibly to the right, almost a quarter-inch off at full contrast. When the screen was fully lit in white, a decidedly gray patch was visible at the upper right, and this patch was unchanged after degaussing.

■ The overall image on the Epsilon Graphics EG-19 was not up to the quality of the majority of the large-screen displays evaluated here.

Some—but likely not all—of these image problems may have been associated only with the test unit. For instance, the character cutoff on the left probably could have been cured with size and positioning adjustments, had they been available to the user. However, the overall image on the EG-19 was not up to the quality demonstrated by the majority of the large-screen displays evaluated here.

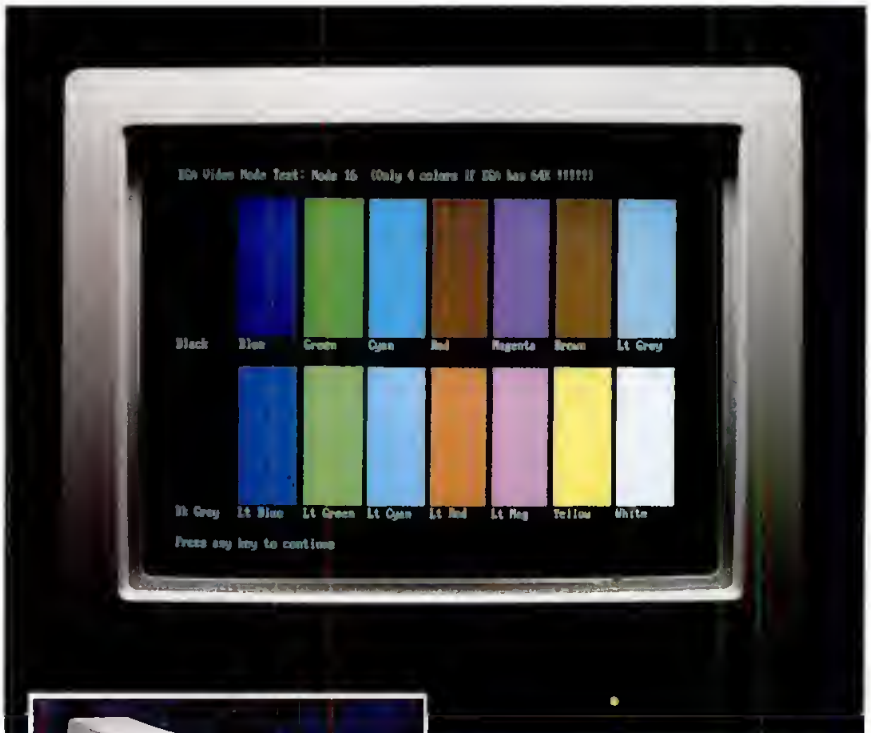
INTECOLOR

MegaTREND

A built-in swivel base, as well as its list price of $1,895 (the lowest among those we reviewed), makes Intecolor's MegaTREND stand out from other large monitors. The dark gray plastic base makes the bulky beige-gray monitor case look sort of like a hovering blimp or, more correctly, a floating pyramid fallen on its side.

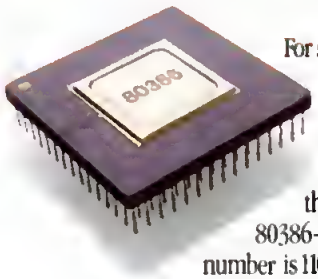
The swivel base also reduces the effective footprint of the MegaTREND to about the same size as that of an ordinary color display and helps it to be a more adjusted (and adjustable) business partner, but it does nothing to shrink the mass of the monitor (Intecolor recommends that you stick the back end of the display out past the rear of your desk!). Even with the added inches of the stand, however, the MegaTREND is no larger than other displays of its kind, measuring 19½ by 19½ by 20 inches (HWD) overall. A rack-mount model that mounts in a standard 19-inch equipment rack is also available.

All of the MegaTREND's controls are located on the top portion of the base, which is affixed to the monitor itself, a commendable placement. These controls include a degaussing push button, brightness and contrast knobs, a rocker switch for power, and a green LED power-on indicator. All of these are accessible from the front.



Color bars on Intecolor's MegaTREND match the IBM spectrum, from black to bright white and all the colors in between, but it is hardly the most brilliant of the displays investigated here.

APPEAL TO A HIGHER



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Storage Devices	1.2MB FDD 40MB HDD, <28ms average access time	1.2MB FDD 40MB HDD, <30ms average access time
Coprocessor Support	80387	80287
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On the rear panel, you'll find nothing more than three jacks: one for power, and two female DB-9 connectors for hooking up video. One video connector is for TTL digital RGB inputs, the other is an output so that you can use other displays with the MegaTREND. The output is amplified so that you can daisy-chain a dozen or more displays, something that may be especially useful in the educational environment and in presentation systems.

TWO MODELS Intecolor offers two CRTs in the MegaTREND, both measuring a full 19 inches diagonally with a medium-dark gray background matrix. One CRT has a dot pitch of .31 millimeters and is antiglare treated. The other uses a .47-millimeter dot pitch and is not antiglare treated. To make up for its coarser image, the latter model is both less expensive and brighter. Both models are U.S. made and sport FCC Class A certification.

The actual image area is the same for both sets but varies in size depending on mode. The EGA image measures 13 by 10 inches, almost 16¾ inches diagonally, while in CGA mode it shrinks to 10 by 7½ inches (12½ inches diagonally).

On the positive side, the screen geometry is almost perfect—straight lines are straight and the aspect ratio registers as close to the IBM standard of 1.33 as does that of any monitor. On the negative side, the EGA image was about one-half inch off center with no positioning control available to the user (this may vary with different video adapters), and the CGA image on the 19-inch tube was hardly any larger than what you'd get on a 14-inch tube!

Screen colors were also troublesome in the coarse-pitch set. It injected too much blue in all low-intensity hues, giving them all a depressing cast. Brown was nearly indistinguishable from red. High-intensity colors were very good, however.

■ As the least expensive of the big-screen EGA displays, the MegaTREND deserves consideration, particularly if you don't want to move on to the VGA standard.

The fine-pitch system matched the IBM spectrum perfectly, from black to bright white and all the colors in between.

The coarse-pitch tube proved to be the brighter of the two. The fine-screen set showed adequate brightness suitable even for bright offices, but it was hardly the most brilliant of the displays investigated here. Blooming was negligible in the fine-pitch display and just noticeable in the coarse-pitch monitor when brightness was fully advanced.

Needless to say, the image quality of the fine-pitch display was the better of the two—in a word, superb. Characters on the coarse screen were fuzzy, probably not acceptable for close work but eminently suited for presentations.

Intecolor is proud of the power supply with which the MegaTREND is equipped because it automatically adjusts itself to any voltage the display is likely to encounter anywhere in the world—from about 80 volts to more than 250. Unfortunately, this power supply proved itself rather unfriendly, biting me when I tried to disconnect the coarse-pitch monitor. This shocking experience occurred with the display switched off when I attempted to remove the power cord and touched the chassis.

The best feature of the MegaTREND is probably its swivel stand. The problems cited above may have been inherent in the particular evaluation machine, although there's no excuse for the small CGA image. As the least expensive of the big-screen EGA displays, the MegaTREND deserves consideration, particularly if you don't want to move on to the VGA standard. Unless your budget and your eyesight rate as poor, however, invest in the .31 millimeter dot-pitch model.

PC MAGAZINE FACT FILE

MegaTREND
Intecolor
225 Scientific Dr.
Technology Park
Norcross, GA 30092
(404) 449-5961
List Price: With .31-mm dot pitch $1,895; .47 mm dot pitch $1,635.
Requires: CGA or EGA adapter.
In Short: A big CGA/EGA monitor with built-in tilt-swivel base, it has a few problems, including small CGA image size, skewed color palette, and nippy power supply.
CIRCLE 695 ON READER SERVICE CARD

MICROVITEC INC.

1019 Definition Autosync

In its 1019 Definition Autosync display, Microvitec incorporates some of the best features and ideas in current large-screen monitors. Imaginative styling, accessible controls, VGA analog and EGA digital inputs, in addition to a bright, sharp screen make for a superb monitor, marred by but a few visual flaws.

The monitor's 19-inch diagonal screen fits into an amazingly compact beige, mostly metal case that's styled with arced wedges (almost reminiscent of the Sydney Opera House) that make it appear even smaller. The 17½ by 18½ (HW) front of the set surrounds the screen and recedes

PC MAGAZINE FACT FILE

1019 Definition Autosync
Microvitec Inc.
1943 Providence Ct.
Airport Perimeter Business Ctr.
College Park, GA 30337
(404) 991-2246
List Price: $2,195 (includes cables, tilt-swivel base).
Requires: CGA, EGA, PGC, or VGA or 8514/A adapter.
In Short: An amazingly affordable display. Packed with cables and resting on a tilt-swivel base, it generates a good image using any current IBM video standard.
CIRCLE 694 ON READER SERVICE CARD

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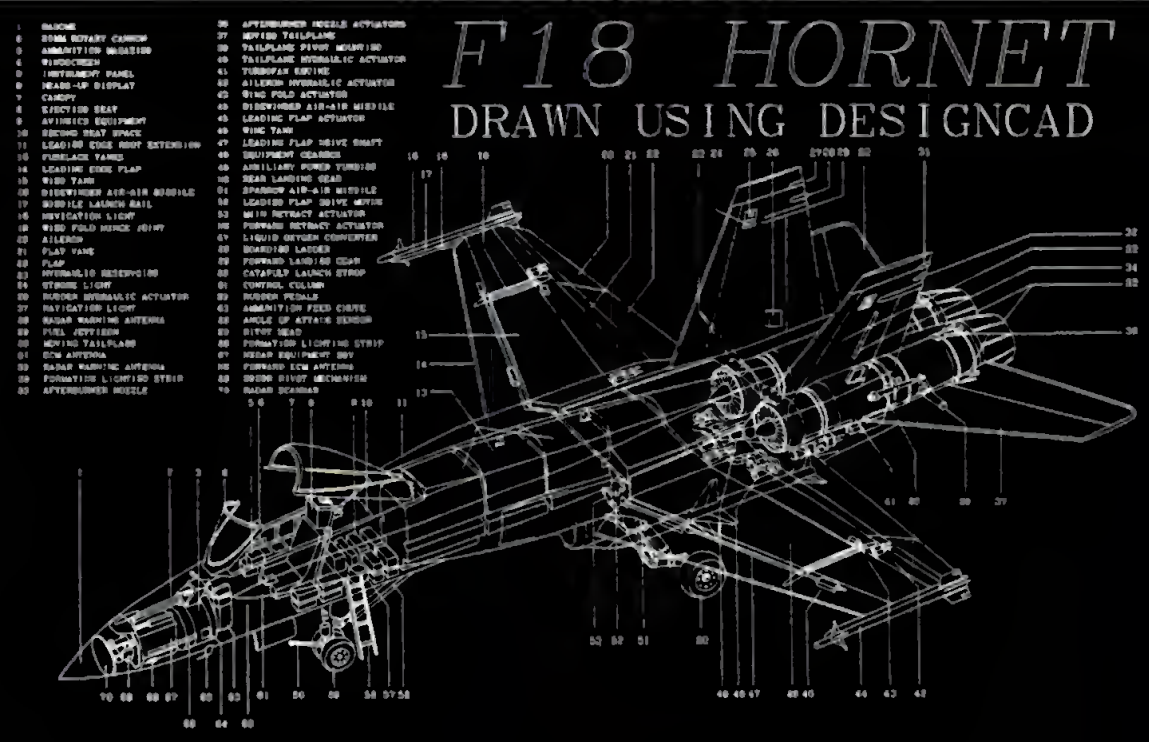


CIRCLE 475 ON READER SERVICE CARD

Color saturation is superb on Microvitec's *1019 Definition Aatosync, matching IBM's official scheme. But we had to fully rotate the contrast control to suppress annoying illumination of supposedly black areas of the screen.*

back about 8 inches, then tapers to a much smaller profile incorporating several acute angles along the way for a total depth of about 20 inches. It's a clever design solution to a massive problem, and it comes at a list price of $2,195.

According to Microvitec, a tilt-swivel adapter will be supplied at no charge with new 1019 Definition monitors, although none was received with the evaluation unit.

On the Definition's rear box, you'll find a minimum of connectors and controls to worry about—separate female DB-9 jacks for analog and TTL inputs, a jack for the power cord, on/off switch and slide switch for 4-bit, 6-bit or automatic TTL interface selection. According to Microvitec, the Definition will be accompanied by both analog and TTL signal cables that are 6 feet long.

The Definition screen itself sits about 3 inches above the base of the case, which has a recessed half-inch-high pediment around its bottom. A curved, darker beige plastic bezel surrounds the screen.

At the lower right of the bezel is a full set of controls; from left to right, the obligatory brightness and contrast knobs; a manual degaussing push button; a rotary switch to select between TTL, analog, and two auxiliary modes; and four small image-size and-positioning shafts.

These last controls put screen geometry—image size and shape—at your beck and call. You can expand the EGA image to fill the screen, broaden it Cinerama-style, or give your character fonts an El Greco look. The separate height (vertical size) and width (horizontal size) controls make the screen aspect ratio variable at will, so with minimal effort you can make it a perfect 1.33. The VGA image was equally responsive.

Perhaps the most pleasing image size was already set when the Definition was delivered—14 by 10¼ inches (17 inches diagonally) in EGA mode—which, although it did not fill the screen, eliminated even the hint of image distortion. With the same size and position settings, the VGA image was about the same size, but CGA mode elicited a smaller image: 10¼ by 8¼ inches (13½ inches diagonally).

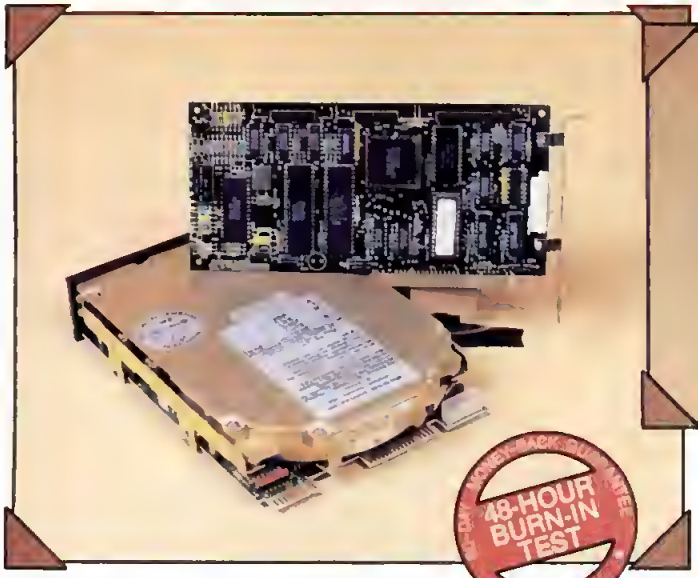
The tube of the evaluation unit featured a high-contrast, almost black matrix but was not antiglare treated. Color saturation and spectrum were superb, matching IBM's official scheme perfectly with a minimum of control fiddling. Because of the tube's small dot pitch (.31 millimeter), all characters are sharply defined, giving a precision look to the on-screen presentation.

APPARENT ABERRATIONS Move only slightly from the optimum control settings, however, and aberrations become apparent. Excessively increasing brightness caused the image to elongate vertically and curve around its images and black level became unusually high.

More annoying still were artifacts of some kind (ringing, or a repeating pattern) on either edge of the screen that did not change when adjusting the width or horizontal positioning controls. With a white background, a thin pale-gray bar (1.4 inches on the left, ⅛ inch on the right) edged the active video area no matter what the brightness or contrast setting. According to Microvitec, this problem has been corrected (by adjusting a resistor value) in current production units.

The best feature of the made-in-England Microvitec monitor is price—it's about $600–700 less expensive than most monitors its size. Add in its VGA-and-beyond multiscan abilities, extra features (tilt-swivel base, two video cords), and so-

THE HARD DRIVE SPECIALISTS



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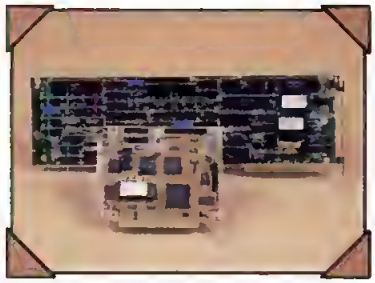
80MB Seagate, 28ms $895



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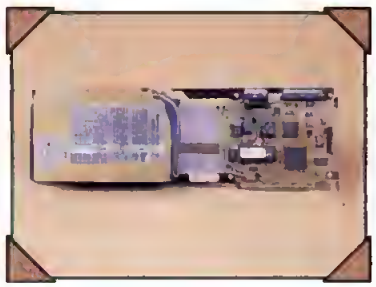

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System Requirements:
IBM PC/XT/AT/PS/2 & Compatibles. MS-DOS 2.0+
256k memory

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CIRCLE 212 ON READER SERVICE CARD

■ 19-INCH EGA MONITORS

PC MAGAZINE EDITOR'S CHOICE

Overall, the displays reviewed here disappointed us and so there is no Editor's Choice. For $2,000 to $3,000 you should expect a display that works well when you get it. But even the best of these displays showed problems over which you may have no control.

Our first choice would be for a monitor with VGA compatibility. You won't want to chuck a $2,500 investment when the new video standard takes over.

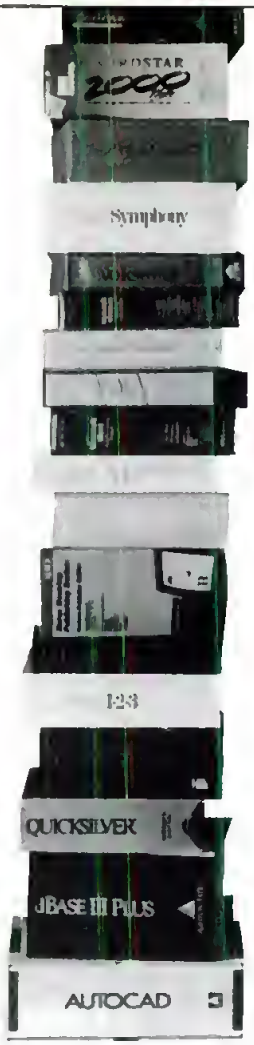
After control twiddling, the Conrac Model 7250 Auto-Trak gave the best image, but quality appeared inconsistent. The Microvitec 1019 Definition Autosync would have earned our nod if we had seen a sample without ringing (a repeating pattern) and with an antiglare treated tube. Although the Electrohome Vari-Scan ECM1910 worked properly, perfectly, and consistently throughout its control range straight from the box, its screen brightness was low. And at a $2,795 list price, it was also one of the most expensive.

From what we received, we'd have to say the Electrohome is the best choice causing the fewest worries. However, if the promised improvements are actually made in the Microvitec, its more affordable price would make it the more-attractive model.

If you don't need or want VGA compatibility, one look at cost and quality will make the choice clear. Buy the Intecolor MegaTREND, but only in its .31 millimeter dot-pitch version.

lutions to some of its problems, and the 1019 Definition Autosync becomes the best buy among the biggies. PC

Winn L. Rosch is a contributing editor of PC Magazine.



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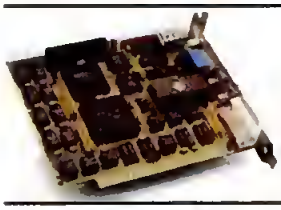

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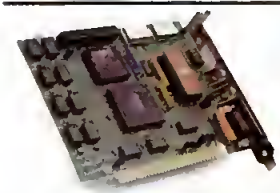

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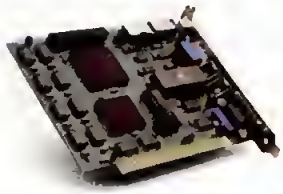
PC MAGAZINE EDITORS CHOICE



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CIRCLE 189 ON READER SERVICE CARD

■ CONNECTIVITY: A CONTINUING SERIES ■

MAKING CONNECTIONS

AT&T's 3B2/600 and StarLAN

AT&T's UNIX-based 3B2/600 minicomputer acts as a PC server on a StarLAN network and an asynchronous terminal host. Although expensive and slow, the system allows minis and PCs to share data.

FRANK J. DERFLER, JR.

The idea of using a minicomputer running under a true multitasking and multiuser operating system as a server for a network of DOS-based PCs has been steadily gaining in popularity. For instance, Digital Equipment Corp. recently introduced such a system, which we reviewed in "Making Connections: DEC Meets DOS" (*PC Magazine*, Volume 6 Number 16).

And now AT&T Information Systems has also jumped on the bandwagon. The company has given its StarLAN network the ability to connect computers running under the UNIX operating system with those running under MS-DOS. In this review, we test such a system using the AT&T 3B2/600 minicomputer as a file server for a network of five IBM PC ATs running under DOS. We tested the server running under AT&T's *StarLAN Network Program* software; we connected the PC ATs using StarLAN network interface cards.

In our series on networking, we've reviewed several variations of AT&T's StarLAN ("Making Connections: LANs Under NetWare," *PC Magazine*, Volume 5 Number 21; "Making Connections: AT&T's StarLAN," *PC Magazine*, Volume 5 Number 22). The configuration reviewed here is yet another piece of AT&T's multifaceted system. StarLAN is also a vital component of AT&T's answer to DEC's DECnet and IBM's System Network Architecture. Combined with AT&T's Premises Distribution System and Information System Network, StarLAN is a hierarchical networking scheme that can provide connections for corporate voice-

and-data networks, hook PCs to larger host computers, and bridge LANs over long distances.

MINICOMPUTER SERVICES Using a minicomputer as a DOS server has a number of advantages and a few potential drawbacks. One significant advantage is that you can use relatively expensive minicomputer systems as a server for both terminals and PCs, giving you double use of the mini. PC applications requiring gigabytes of data storage won't even faze a minicomputer acting as a file server. An additional gain is that you can use a single vendor for both service and training for all elements of the system.

■ You can use relatively expensive minicomputer systems as a server for both terminals and PCs, giving you double use of the mini.

In addition, because the minicomputer's operating system controls all access to the hard disk drive, programs run by the terminals and on the PCs can share the same file space on the disks. If the applications programs use the same file structure, anyone with authorized access to the minicomputer through an RS-232C connection or through the network can share the data.

One package that already takes advantage of this file-sharing opportunity is the *Smart* series of programs from Innovative Software. *Smart Software System* (which will be reviewed in *PC Magazine*, Volume 6 Number 18) includes DBMS, spreadsheet, and word processing programs that all share files. Innovative Software offers one version of *Smart* for the UNIX V operating system and another networked version for MS-DOS machines. Terminals attached to an AT&T 3B2 series computer can run *Smart* in the minicomputer, and PCs attached through StarLAN can run *Smart* in their own PCs. And all can share *Smart* data files created on the minicomputer's hard disk drives. This kind of program-to-program connectivity solves training problems and overcomes data transport limitations between PC workstation and minicomputer terminal users.

The downside to using minicomputers as servers for PC networks relates to speed and cost. Although all of the minicomputers that we have tested work reliably and provide adequate speed, none give the fastest possible file service to DOS-based PCs. Therefore, if you need top performance, you should consider including an IBM PC AT or compatible as a server on your network.

Minicomputers are also expensive. The 3B2/600, for instance, costs $46,500. And unlike PC-based LANs, you cannot expand a minicomputer's power in linear proportion to its cost. So you probably shouldn't consider buying a minicomputer just to act as a server for DOS-based systems. However, it is worth using the minicomputer for this task if you already have one or need one anyway.

3B2 AND UNIX Under the StarLAN system, the 3B2/600 or other 3B2 minicomputers can act as a server for both PC workstations connected over the network and ASCII terminals attached through individual RS-232C connections. The server software that allows DOS PCs to share files and printers runs as an application on the minicomputer. Although the terminals and PCs both share the disk storage of the minicomputer, the PCs run programs in their own processors and RAM while the terminals run programs in the shared processor and RAM of the minicomputer. As a result, when the terminals run programs and perform tasks, they can place a significant load on the minicomputer's CPU and disk storage system. Networked PCs using the minicomputer as a server, however, have little effect on the minicomputer's CPU but can place heavy loads on its disk storage system.

The 3B2 line of minicomputers, from the small 3B2/20 to the large 3B2/600, run under UNIX and are all 32-bit machines using processors from Western Electric. In

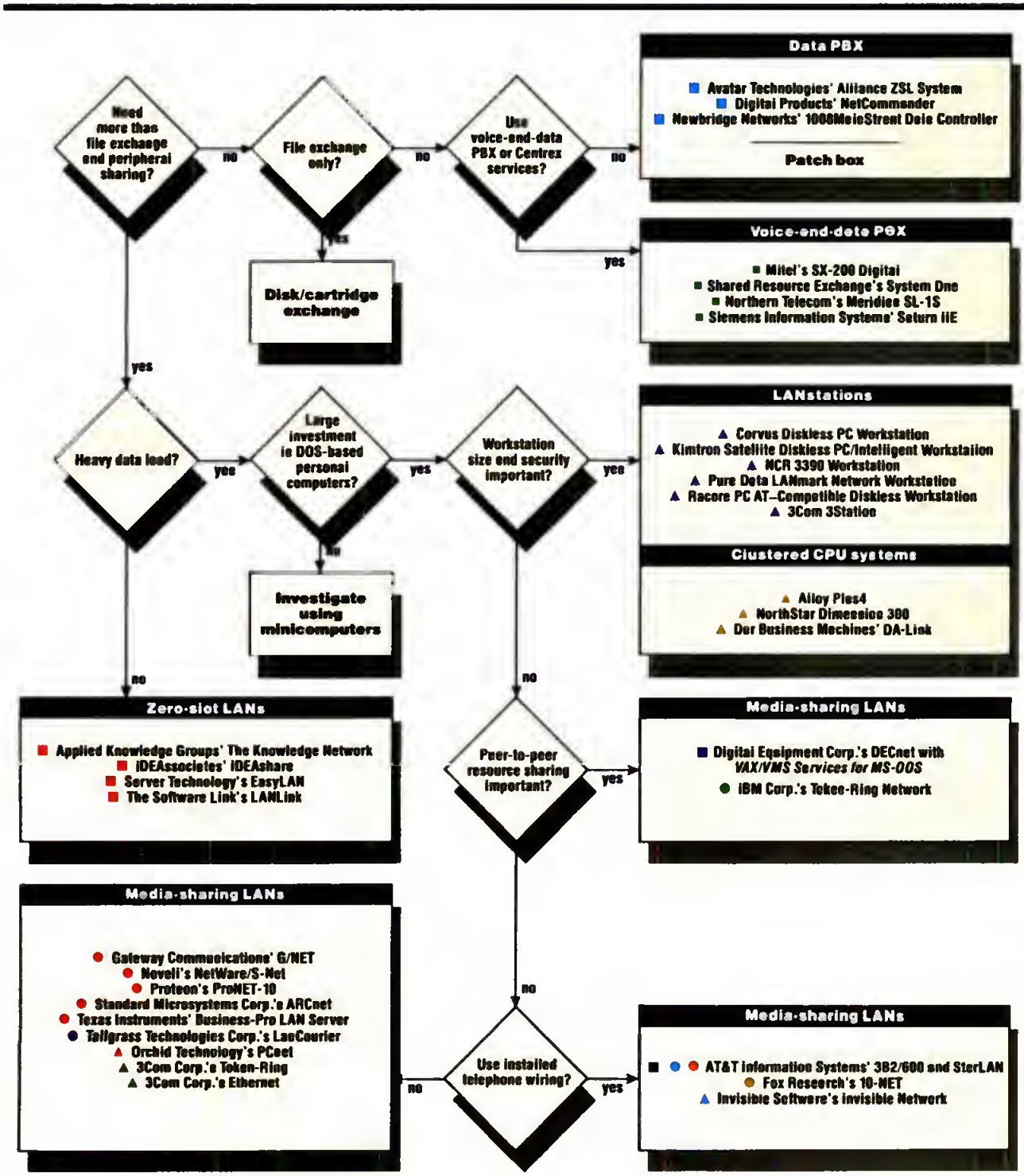
The Connectivity Decision Guide

This chart is designed to help you select from among the many information-transfer and resource-sharing alternatives. As you can see on the chart, if all you really need to do is exchange files or share printers, then you should consider devices such as PBXs and patch boxes. If your organization has not already invested heavily in PCs or DOS programs, then a minicomputer might meet your needs more economically. But if you want many users to share data files simultaneously under DOS, a LAN may be the best alternative. Once you've decided on a LAN, the need for station-to-station resource sharing and other factors will influence your network purchasing decision.

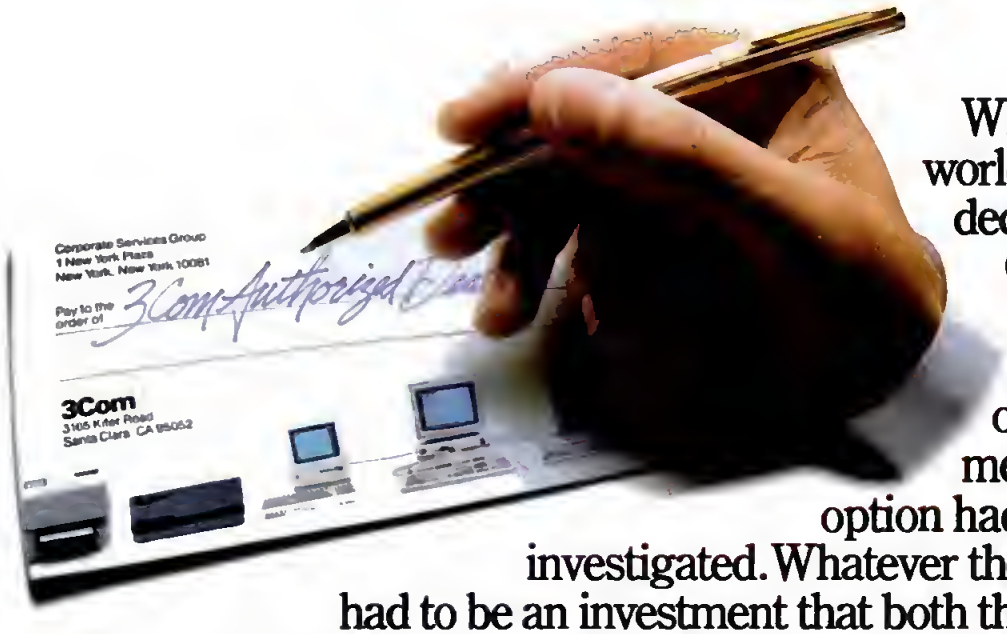
Because manufacturers include many different features in their networks, some products will not fit neatly into one decision box in this guide. You'll also find that the lack of differentiation between LANs is becoming as large a problem in the LAN industry as the lack of standards was 2 years ago. But overlapping features and technical similarity between networks are good news for potential buyers. They will let you concentrate on more-traditional factors such as dealer support and price instead of on more-technical considerations.

Reviews originally appeared in *PC Magazine:*

- Volume 5 Number 21
- Volume 5 Number 22
- Volume 6 Number 1
- Volume 6 Number 2
- Volume 6 Number 3
- Volume 6 Number 4
- Volume 6 Number 6
- Volume 6 Number 7
- Volume 6 Number 10
- Volume 6 Number 11
- Volume 6 Number 12
- Volume 6 Number 13
- Volume 6 Number 14
- Volume 6 Number 16


Need more than file exchange and peripheral sharing?
no
File exchange only?
no
Use voice-and-data PBX or Centrex services?
no
Data PBX
Avatar Technologies' Alliance ZSL System
Digital Products' NetCommander
Newbridge Networks' 1088MainStreet Data Controller
Patch box
yes
Disk/cartridge exchange
yes
Voice-and-data PBX
Mitel's SX-200 Digital
Shared Resource Exchange's System One
Northern Telecom's Meridian SL-1S
Siemens Information Systems' Saturn IIE
yes
Heavy data load?
yes
Large investment in DOS-based personal computers?
yes
Workstation size and security important?
yes
LANstations
Corvus Diskless PC Workstation
Kimtron Satellite Diskless PC/Intelligent Workstation
NCR 3390 Workstation
Pure Data LANmark Network Workstation
Racore PC AT–Compatible Diskless Workstation
3Com 3Station
Clustered CPU systems
Alloy Plex4
NorthStar Dimension 300
Der Business Machines' DA-Link
no
Investigate using minicomputers
no
Zero-slot LANs
Applied Knowledge Groups' The Knowledge Network
IDEAssociates' IDEAshare
Server Technology's EasyLAN
The Software Link's LANLink
no
Peer-to-peer resource sharing important?
yes
Media-sharing LANs
Digital Equipment Corp.'s DECnet with VAX/VMS Services for MS-DOS
IBM Corp.'s Token-Ring Network
Media-sharing LANs
Gateway Communications' G/NET
Novell's NetWare/S-Net
Proteon's ProNET-10
Standard Microsystems Corp.'s ARCnet
Texas Instruments' Business-Pro LAN Server
Tallgrass Technologies Corp.'s LanCourier
Orchid Technology's PCnet
3Com Corp.'s Token-Ring
3Com Corp.'s Ethernet
no
Use installed telephone wiring?
yes
Media-sharing LANs
AT&T Information Systems' 3B2/600 and StarLAN
Fox Research's 10-NET
Invisible Software's Invisible Network

WHY CHASE MANHATTAN OPENED ITS ACCOUNT WITH 3Com.



When one of the world's biggest banks decided to network its Corporate Services Group, the long term implications of such a decision meant that every option had to be thoroughly investigated. Whatever the final decision, it had to be an investment that both the group and the bank could live with for a long, long time.

Rejecting mainframe/mini/terminal configurations for cost reasons, they decided a PC-based workgroup system was the answer.

Chase's Corporate Services management chose 3Com's 3System, supplied and supported by a 3Com Authorized Dealer.

The 3System for Chase's Corporate Services links five buildings in the Wall Street area and will eventually expand to facilities in upstate New York. Multiple 3Servers run 3+ operating software and 3System's superior electronic mail to multiple users.

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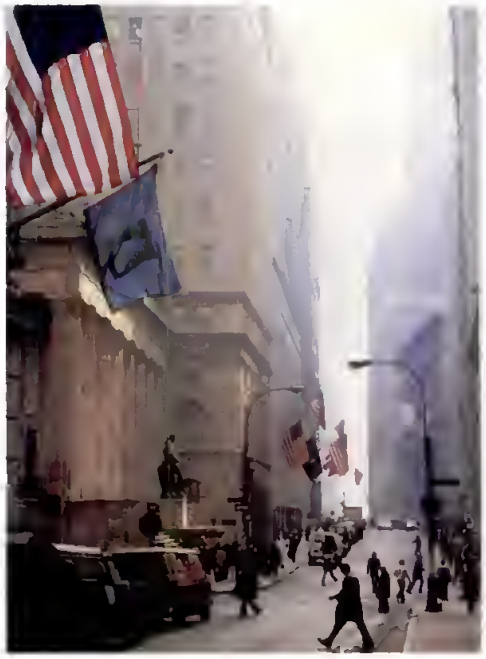
3System also allows network users entry to the bank's IBM mainframes via Bridge Communications gateways. Data can be downloaded to the 3Servers, then accessed by any member of the workgroup.

And because of 3System's security, managers and other administrative staff can share data and handle the most confidential of business transactions.



Like other 3System users, Chase Corporate Services Group found it could run an almost limitless choice of application software on its network.

They chose "Smart," an integrated package combining database, word processing and spreadsheet, the "Higgins" workgroup personal productivity program and DNET Menuing software.

Since it has been installed, 3System has had no downtime. And because all data is backed up nightly, there hasn't been a single instance of lost data either.

Other major Wall Street financial companies like Chemical Bank of New York, Merrill Lynch and Shearson Lehman/American Express share Chase Corporate Services Group's enthusiasm.

That's why they've also opened accounts with 3Com.

For your nearest 3Com dealer, call 1-800-NET-3Com.

PC MAGAZINE EDITORS' CHOICE

3Com
WORKGROUP SYSTEMS

of Innovative Software. Higgins is a trademark of Conetic Systems, Inc. DNET Menuing is a trademark of Delta Technology International, Inc.

CIRCLE 238 ON READER SERVICE CARD

■ The 3B2 line of minicomputers runs under UNIX. All of them are 32-bit machines using processors from Western Electric.

fact, the 3B2 systems are designed as "UNIX engines," with processors and architectures optimized for that operating system.

The latest version of the operating system released by AT&T (IBM and other companies use different versions of UNIX) is UNIX V Version 3.1.1. Unlike MS-DOS (even OS/2), UNIX V is a complete multitasking and multiuser operating system. Unlike even relatively mature network operating systems for PCs, such as 3Com Corp's *3+Share* and Novell's *NetWare*, UNIX has sophisticated abilities that allow several stations to share simultaneously the same record or bytes in a data file. But while "real programmers" love UNIX's flexibility, its arcane user interface puzzles and alarms other users.

The 3B2/600 machine we evaluated as a server supports from 25 to 64 concurrent users. It offers a maximum of 90 serial connections for terminals, modems, printers, and other devices. The 3B2/600 has a proprietary 4-megabit-per-second I/O bus structure with 11 available expansion slots. The system is slightly larger than two PC ATs stacked on top of each other. You use a separate RS-232C terminal to control the system.

The 3B2/600's 18-MHz WE 32100 processor can address up to 16 megabytes of RAM, using a special Error Correction Code system that ensures data integrity. The processor has both a 32-bit data path and a 32-bit address path and is rated at 2.6 million instructions per second. The internal hard disk drive has 294 megabytes of formatted storage space, and its external hard disk drives can hold up to 6.5 giga-

Benchmark Tests: AT&T 3B2/600

These results show that the AT&T 3B2/600 acting as a server is not the fastest machine we have tested. Such results should be expected, however, because the system must translate between DOS calls and UNIX commands and this imposes overhead on the system. However, the system does give responses that are acceptable for most network operations. While we made no attempt to load the UNIX terminals attached to the 3B2, you should expect that disk-intensive activities on these terminals will also have some effect on the PC LAN's performance.

Network Speed Under Load

Performance Times
(Times given in seconds)

Server	Interface card	Software	Zero stations	One station	Two stations	Three stations	Four stations	Five stations
AT&T 3B2/600/AT&T Information Systems	StarLAN 3B2 Network Access Unit	*StarLAN Network Program*	862	923	998	1,118	1,348	1,586
3Server3/3Com Corp.	EtherLink	*3+Share*	306	432	529	651	761	868
8-MHz IBM PC AT/IBM Corp	EtherLink	*Advanced NetWare/286*	264	280	301	310	322	345

Hard Disk Access Load

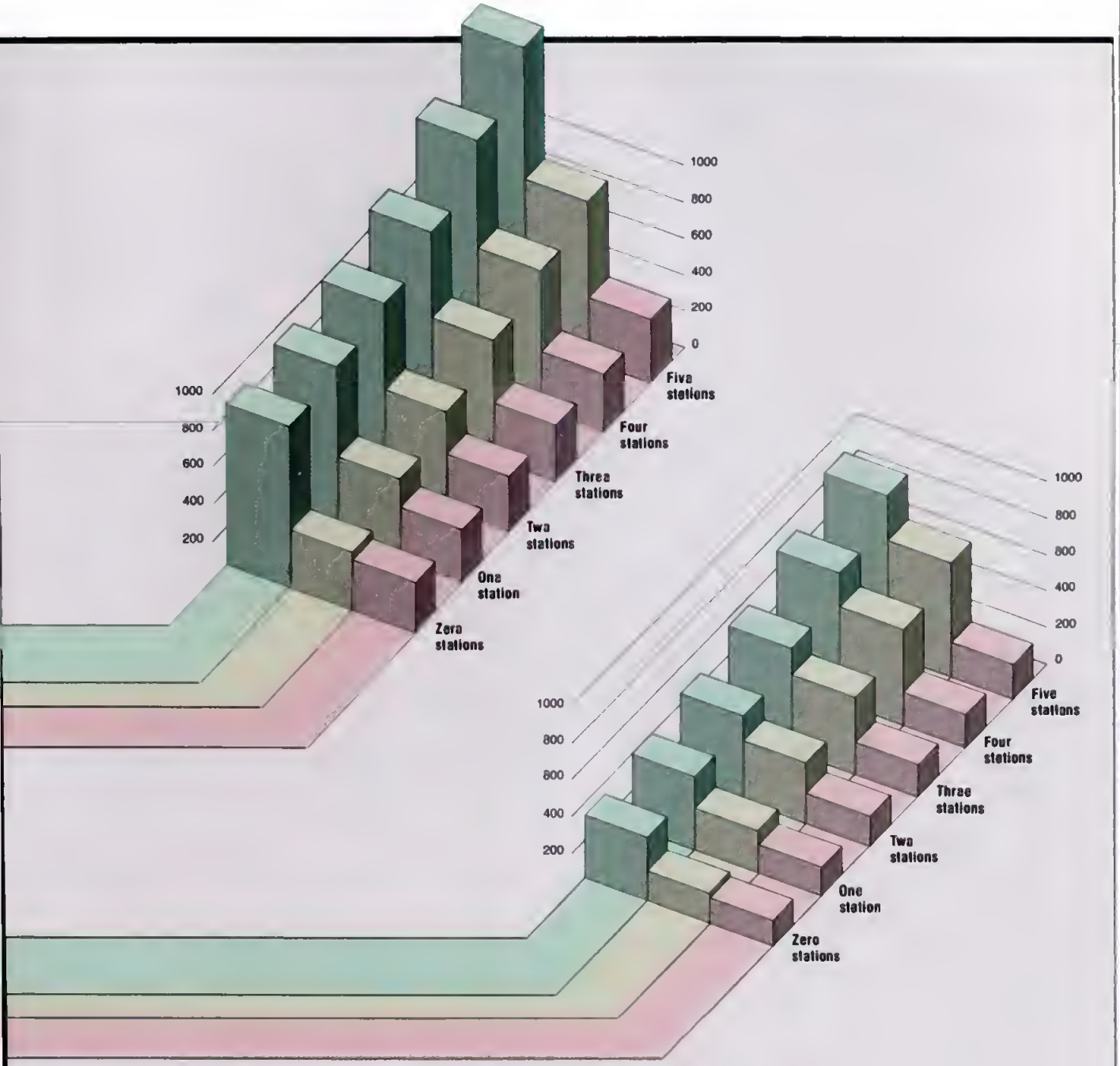
Performance Times
(Times given in seconds)

Server	Interface card	Software	Zero stations	One station	Two stations	Three stations	Four stations	Five stations
AT&T 3B2/600/AT&T Information Systems	StarLAN 3B2 Network Access Unit	*StarLAN Network Program*	335	396	463	564	709	866
3Server3/3Com Corp.	EtherLink	*3+Share*	155	227	330	419	522	620
8-MHz IBM PC AT/IBM Corp.	EtherLink	*Advanced NetWare/286*	136	150	162	174	182	187

The PC Labs LAN benchmark tests are written in C and are independent of commercial software. We ran the tests on a test bed of five 8-MHz ATs. For our test bed to better simulate the conditions on a medium-size network of 20 or more workstations, we have designed these loading tests so that a single station represents five to ten times the load of a user performing an interactive task (for example, updating records) on a network.

By themselves, the elapsed times reported in these tests are not meaningful. They are valuable only when used to compare the performance of two or more systems running under near-identical conditions. Accordingly, we include the tests run on our Editor's Choice configuration of a 3Com 3Server3 running under *3+Share* software with EtherLink interface cards to provide a point of comparison. We also show results from a network of Novell's *Advanced NetWare/286*, EtherLink cards, and an IBM PC AT as the server. *Advanced NetWare* is our Editor's Choice for networking software, and our tested configuration is a typical one.

The **Network Speed Under Load** and the **Hard Disk Access Load** benchmark tests measure the time needed to perform a standardized task on the network. While the actual work loads used for these two tests (described below) are different, we used the same procedures for both. To obtain the elapsed times shown here, we ran a bench-



mark program performing e sequential create, e sequential read, e sequential write, e random read, and e random write of a large file. The record sizes used in these activities systematically rotate between 16K bytes, 4K bytes, and 512 bytes. The numbers shown in the three-dimensional chart are the total time necessary for all of these operations. We ran the test on eit of our ATs to load the network while timing just one of them. We then reduced the number of workstations one et a time to show the affect of loading on the network.

This **Network Speed Under Load** test puts a heavy load on the network interface (cards, media, and so forth) while placing e minimal load on the hard disk by having each station continuously read and write its own 1-byte data file, changing the data each time. For systems with disk caching, the load on the hard disk is even smaller since cached systems typically perform a disk write but do not require e physical disk read.

The **Hard Disk Access Load** test heavily loads the hard disk and disk-caching system. To do this, each station randomly accesses its own 100K-byte data file using 1K byte records. Data written to the file is changed each time. The random reads typically access data outside the cache, which forces e disk read, as does any write.

FACT FILE

AT&T 3B2/600
AT&T Information Systems
1 Speedwell Ave.
Morristown, NJ 07960
(800) 247-1212
List Price: $46,500, including 4-Mbyte ECC Memory Card, two 147-Mbyte hard disk drives, 720K-byte floppy disk drive, three EPORTS cards, SCSI host adapter card, 60-Mbyte cartridge tape; Multi-Processor Enhancement, $3,500; additional 2 Mbytes RAM, $3,000; additional 4 Mbytes RAM, $5,000.
In Short: Using the AT&T 3B2/600 as a server for a StarLAN network offers the advantages of allowing you to share applications files between terminals and PCs, limiting training and maintenance problems, and giving you double use of the minicomputer. On the downside, the performance doesn't measure up to an AT acting as a server running under certain networking software and the cost is higher.
CIRCLE **637** ON READER SERVICE CARD

The AT&T 3B2/600 minicomputer is shown with the front cover down, revealing the disk and tape drives. On top of the computer are two StarLAN network cards for IBM PC–type workstations and beside it is an AT&T Network Extension Unit that acts as a hub for StarLAN.

Photograph: Richard Lakin

bytes of data. The drives use the new fast ESDI controller technology.

You connect the 3B2/600 to external disk drives and other peripherals through two fast small computer system interface (SCSI) host adapters. A 60-megabyte SCSI cartridge tape is part of the 3B2/600's standard configuration.

The 3B2/600 offers optional gateways to numerous IBM mainframe systems, high-speed interfaces to packet-switching networks, and AT&T's 1.544-megabit-per-second high-speed data lines. AT&T has implemented a wide variety of protocols for large-scale networks, including the Telecommunications Control Program/Internet Program specified by the Department of Defense and used in many corporate and institutional computer networks. Through these options, you can use the minicomputer as a communications server for PCs connected through the StarLAN network.

STARLAN The 3B2/600 connects to PCs through a StarLAN network interface card that you insert in its internal bus. StarLAN uses a twisted-pair wiring scheme that you hook to the minicomputer and other workstations simply by clicking an RJ-45 telephone-type connector into place.

Technically, the StarLAN network is a version of the IEEE 802.3 (Ethernet) standard designed for twisted-pair wiring. This standard describes the carrier sense multiple access media-sharing protocol scheme. Although the speed of this media is listed at 1 megabit per second, as compared with the 4- and 10-megabit-per-second specifications of other systems, repeated tests proved that the throughput of the media or of the network cards is not necessarily a limiting factor. Under Novell's *Advanced NetWare*, the StarLAN media's performance compared favorably with systems rated at much higher transmission speeds.

One of the StarLAN network's nicest features is the flexibility it allows you for physically configuring your LAN. You can attach PCs in a station-to-station wiring scheme to a maximum distance of 800 feet. This configuration is economical and operationally effective.

You can also set up StarLAN in a physical hub topology, in which each station is attached to a central connection box over a cable with a maximum length of 800 feet. This kind of system makes troubleshooting easier, gives better system reliability, and lengthens the allowable distance between stations. In addition, you can mix hub and station-to-station connections for even greater flexibility.

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- ***EasyLAN* shares printers, plotters, data, and disk storage**
- **Supports up to 18 PCs or compatibles**
- **New Network Commands**
- **New NETBIOS**
- **PC to PC file transfer**
- **Print spooling**
- **PBX support**
- **Easy to install**
- **Easy to operate**
- **Modem support**
- **Performs in the background**

EasyLAN's low price matches the small business user's cost-sensitive budget. It is the office network solution for less than $100 per PC.

EasyLAN performs its operations concurrently in the background. *EasyLAN* communications, file transfers and printer operations all take place while each PC simultaneously performs such normal DOS applications as Lotus 1-2-3,™ Wordstar,™ and dBASE.™

NEW NETBIOS SUPPORT—WRITE YOUR OWN COMMUNICATIONS PROGRAMS.

Programmers may use *EasyLAN* to develop network applications using NETBIOS (interrupt 5c) These applications can now be operated across the low cost RS-232 communications links used by *EasyLAN* Our new *EasyCALENDAR* program is an example of a network application that uses NETBIOS for program to-program communications.

Multi-user data-base management applications that require a high-overhead network operating system will perform faster on high-cost networks operating at megabit speeds.

NEW VERSION 3.0 COMMANDS EXPAND NETWORK FLEXIBILITY

EZCLOCK lets PC's attached to the network read the time and date from a single master clock on the central PC, eliminating the need to install individual clock boards in each PC and insuring that all file entries and updates made across the network are dated.

The EZ Make Directory and EZ Remove Directory commands function identically to the DOS MKDIR and RMDIR commands, and give remote users increased flexibility when it comes to managing subdirectories on the central PC

EZBEEP lets you send an audible signal across the network, alerting a PC user that a file or message is being sent.

***EasyLAN* PBX SUPPORT BRINGS NEW FLEXIBILITY TO PC CONNECTIVITY**

With *EasyLAN's* PBX support, users can share peripherals and transfer files using PBX switched-circuit connections and existing twisted pair wiring. *EasyLAN* has already been installed on a number of different PBX's, and recently was certified by Northern Telecom for use on its Meridian SL-1

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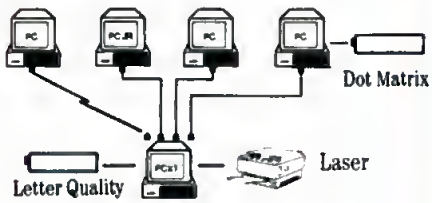
Disk sharing uses *EasyLAN's* EZCOPY command to move files to and from PC's. ASCII or binary files can be transferred in the foreground, or in the background while other DOS programs run.

Printer sharing operates transparently with existing programs. Print files are automatically spooled to disk and scheduled for printing. Multiple printers on the central PC may be designated for individual printing tasks.



***EasyLAN* Office Network**

EasyLAN SPECIFICATIONS

Each PC in the network requires an individual licensed copy of the *EasyLAN* program and takes 20k of memory on each satellite PC, a serial port, and DOS 2.0 or above. *EasyLAN* runs on all IBM PC models and compatibles. The central PC requires a serial port for each satellite PC. The COM2 and COM6 boards are serial port expansion boards which permit you to add serial ports to the central PC.

EASY TO INSTALL

EasyLAN can be installed in less time than it takes to enjoy your coffee break. Just plug the *EasyLAN* cables into existing serial ports. The *EasyLAN* Network Configuration Program provides menu driven installation program that will guide you step-by-step through the software installation process.

***EasyCALENDAR*—USE YOUR NETWORK TO SCHEDULE MEETINGS.**

The first of a new series of *Easy* network application products using NETBIOS is now available. *EasyCALENDAR* handles time management applications for individuals or a department and can be run on personal computers attached to any NETBIOS compatible network

Highlights:

CALENDAR MANAGEMENT for individuals and the work group

TASK MANAGEMENT to create, maintain and review to do lists

TODAY'S NEWS for broadcasting messages, notices or announcements across the network

MENU INTERFACE for easy set-up and use

EasyCALENDAR's Data base for appointments, to do lists and news resides on the central PC Satellite PCs attached through *EasyLAN* version 3.0 send network transactions to the central data base to invoke *EasyCALENDAR* functions

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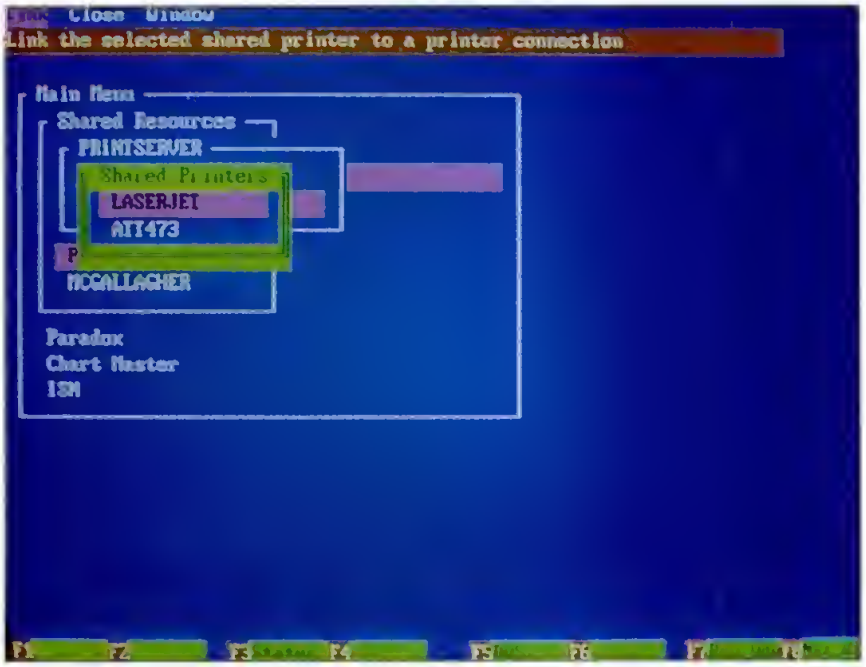
Item	Description	Price	Qty	Amount
EL 02	*EasyLAN* Kit—for 2 PCs 30' cable, two disks & manuals	$219.95	____	$ ____
EL 03	*EasyLAN* Expansion Kit—for 1-PC 30' cable, one disk & manual	$119.95	____	$ ____
EL 10	*EasyLAN* disk & manual (3½" disk $109.95)	$ 99.95	____	$ ____
EL 12	*EasyLAN* 30' cable	$ 49.95	____	$ ____
EL 13	COM2-serial port expansion board, two ports	$219.95	____	$ ____
EL 14	COM6-serial port expansion board, six ports	$489.95	____	$ ____
EC 01	*Easy CALENDAR* Kit Supports 6-PC's and 10 people	$199.95	____	$ ____
EL 15	Custom length cables, call for quote			
	CA res. add applicable sales tax			$ ____
	Shipping charge USA $10.00, other $20 00			$ ____
			TOTAL ORDER	$ ____



The StarLAN software's Link command, shown using tiled menus, allows PCs and 3B2 minicomputers to act as servers for the same network.

AT&T markets StarLAN network interface cards for its mini and microcomputer systems, but the company is no longer the sole source of StarLAN products. Western Digital Corp. is in competition with AT&T and is putting out a heavy marketing and production thrust. In addition to offering StarLAN cards for standard PCs, Western Digital also offers a small StarLAN card customized for the Toshiba T3100 laptop computer. The growing popularity of the StarLAN system means that cards and interface software will be available for more types of computers from more vendors.

NETWORKING SOFTWARE The purpose of this review is to test the 3B2/600's capabilities as a server, not to test the StarLAN network. Therefore, we did not evaluate the *StarLAN Network Program* separately, although we will provide a recap of the software's major features. However, we can say that the version we saw running on the 3B2 system appeared more mature, flexible, and responsive than the version we tested nearly a year ago run on a PC-type server.

The AT&T StarLAN software is an adaptation of the 3Com networking software, which includes the *Microsoft Networks (MS-Net)* redirector, with added utilities and menus. As a result, the StarLAN software's commands and operational techniques will be familiar to anyone who has used these systems.

An important feature of the StarLAN software is its Link command, which programs the *MS-Net* redirector module to intercept DOS commands and route them to the server for execution. This command allows PCs and 3B2-type minicomputers to act as servers for the same network. As a network user, you would see files on a particular server as belonging to another disk drive on the PC. You can make server-to-server file transfers using the same commands you would use to transfer files between disk drives.

For example, you might see the files on the minicomputer as drive M: and the files on some other server in the system as drive O:. You could actually connect applications programs sending data to the local LPT1 to the parallel port of a server on the network by using the Link command.

The StarLAN software also allows any MS-DOS PC on the network with at least 10 megabytes of hard disk storage to act as both a server and a workstation concurrently. Any workstation can also contribute disk drives or I/O ports to the network. We didn't test this operational mode, but our experience has been that it is best used in small work groups with a traffic load that consists mainly of infrequent file transfers.

The AT&T program includes a NETSTAT display that shows the active stations on the network and other useful network information. The software features an extensive set of menus that allow the workstation operator to select network resources, arrange files, and control printing tasks. The menus work through multiple windows and can be customized by the network administrator.

The StarLAN program also offers a flexible print queue system. Anyone submitting a job for printing can view the entire print queue to determine the wait for a particular printer. The software signals when the printer is off-line and allows the administrator to prioritize print requests.

Security is good in the StarLAN software. In addition to providing a normal password log-on routine, you can protect individual directories with passwords and specify files for read-only, write-only, or exclusive use. The UNIX operating system prevents files on a 3B2 server from being accessed by RS-232C terminals attached to the minicomputer.

The StarLAN software, like that of IBM and 3Com, uses a significant amount of memory in PC workstations, even when the workstations are not using the network. Network drivers are loaded into memory by the CONFIG.SYS file during boot-up. The combination of the network workstation and server modules, DOS, and network menus can take up to 384K bytes of RAM. More typically, what is termed the "client software" (workstation-only, without menus) takes about 162K of memory. However, losing even this amount of RAM could be significant to people who use large spreadsheets or other memory-hungry programs.

OPERATIONS You can load software for the 3B2/600 server from disks or tape drives in a logical and fast installation process. The 3B2 operator creates a separate

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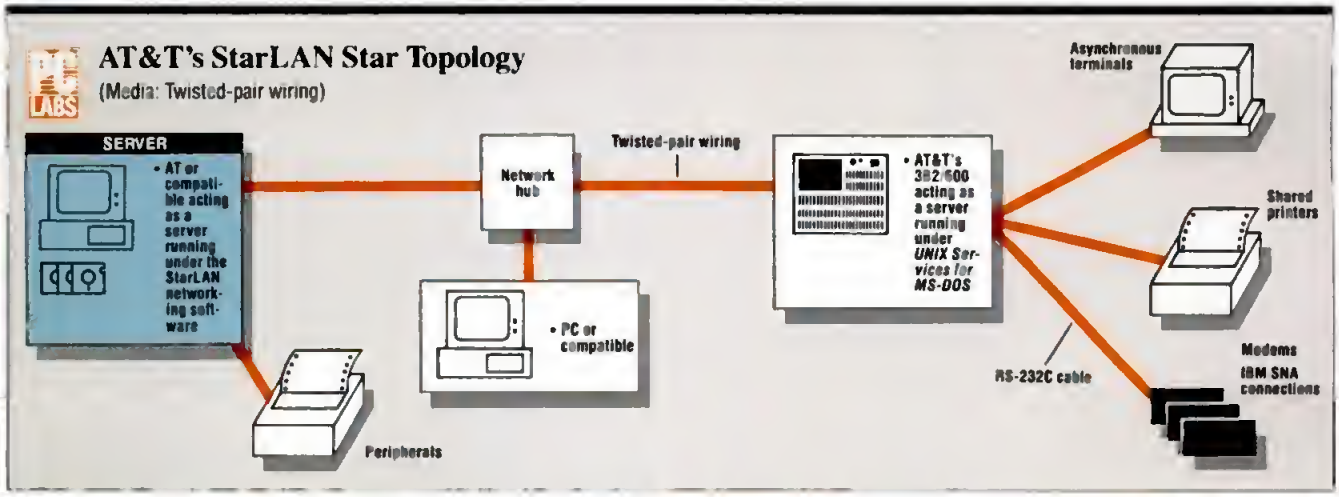

The AT&T 3B2/600 minicomputer acts as a server for a network of MS-DOS–based PCs and as a host for ASCII terminals connected via RS-232C cable. Other minicomputers or PC-type systems can also act as servers on the network. The StarLAN network uses twisted-pair wiring, which the stations share via the CSMA/CD (carrier sense multiple access with collision detection) protocol. The nodes on the network can be connected through a hub or in a station-to-station wiring configuration.

process running in the multifunction UNIX job stream for each user on the DOS network. This program interacts with the MS-DOS commands coming from the network workstation and hands them off to UNIX for execution.

After the users have a place to talk to in the UNIX system, they are ready to interact with the network. The network administrative functions of assigning passwords, giving users capabilities and limitations within the system, and monitoring operations such as print spooling can be done either from the UNIX terminal side of the system or from the DOS network side.

Installing the networking software on the workstations consists of creating a disk with the proper files and modifying the CONFIG.SYS program to load the StarLAN software drivers. In typical network installations, the system administrator might also spend several days per workstation arranging files and creating batch files that link users to the data files and other network resources that they typically want to use.

TEST RESULTS We did not attempt to load the UNIX side of the 3B2/600 for our benchmark tests. The load placed on the minicomputer by the UNIX applications can vary widely. Certain types of disk-intensive operations such as DBMS file access could slow down operation of the DOS network considerably, while other types of operations, such as word processing, might have little effect on the network. Certainly, there will be work load interaction in both directions between the activity on the network and the activity on the UNIX terminals.

■ The performance of the 3B2/600 as a DOS server was not as fast as an 8-MHz AT running under Novell's *NetWare*.

Because our tests were run with 8-MHz ATs running "wide open," we feel that they represent a much heavier load than that normally used on the number of stations we tested. The hard disk drive of the 3B2/600 was certainly exercised by the network activity, although the server programs barely tickled its CPU.

The buffers established by the 3B2 server and PC client software were sized according to the settings recommended in the manual or established by default. You can adjust or tune these to improve performance, but as Novell and other vendors advise, tuning buffers is a trial-and-error process that is very sensitive to the particular application being run. We experimented with larger buffer sizes and found that they degraded performance in some of our tests that randomly read data from disk files. In installations in which certain types of homogeneous programs are run, the StarLAN software allows tuning to improve performance.

The performance of the 3B2/600 as a DOS server was not as fast as an 8-MHz AT running under Novell's *NetWare* or a 3Com 3Server3 running under *3+Share*. The reason is that the translation between DOS calls and UNIX commands places overhead on this type of system.

But top speed isn't the most important factor to many network planners. The ability to share applications files between users with terminals and PCs, to limit training and maintenance problems, to take advantage of significant communications gateway capabilities, and to reuse a valuable asset make using a 3B2 computer as a DOS server a smart move in many workgroup installations. PC

Frank J. Derfler, Jr., is a contributing editor of PC Magazine.

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The Turbo Board Shortcut to 386 Power

Want to step up to a 386-class machine without making a 386-class investment in a new computer? Here are four alternatives: the American 386 Turbo, the PC-Elevator 386, the Cheetah Adapter/386, and the Intel Inboard/386.

Every time Intel introduces a new generation of microprocessor, PC users have to ask themselves what advantages the new microprocessor has for them and how much they're willing to pay for it. The 80386 has several significant advantages over older Intel microprocessors like the 8088 and 80286. The 80386 runs at clock speeds of 16 and 20 MHz, sports 32-bit arithmetic instructions, can address huge amounts of memory, and features the virtual-86 mode, which allows multiple processes developed for the older 8086 or 8088 processors to run at the same time. Overall, the 80386 is a more attractive upgrade path than the 80286 was.

The 80386 has had its teething problems. Intel stopped making the chips entirely while it solved some of the design problems, then restarted the manufacturing line. As you might expect with a chip as complex as this, yields were disappointingly low and the manufacturers were placed on allocation. Since then, yields have improved steadily, but only now are they reaching full volume. The price of the 80386 chip is coming down, albeit slowly. Intel manages the price/volume/marketing curve carefully, and customers know what they'll be paying for the parts long in advance.

While 386-based computers have been available for almost a year, there is still a shortage of software that takes advantage of the special features of the chip. Even Microsoft's much delayed OS/2 will treat a

386 Turbo Boards: Summary of Features

(Products listed in ascending price order)

	List price	Card size	Clock speed (MHz)	Math Coprocessor: Installs on turbo board/ motherboard	Math Coprocessor: 80387 option	Memory Caching: Has memory caching	Memory Caching: Cache memory seperate from main memory	Memory Caching: Can be turned off	RAM chip speed (nanoseconds)
Cheetah Adapter/388 Cheetah International Inc.	$495	3.63 × 3.63 inches*	8	Motherboard	○	○	N/A	N/A	Does not have chip
Americee 386 Turbo American Computer and Peripherals Inc	$1,699	Full length	16	Motherboard	○	● (1 Mbyte, dynamic)	○	○	120
PC-Elevator 386 Applied Reasoning Corp.	$1,995	Full length	16	Turbo board	●	○	N/A	N/A	100
Intel Inboard/388 Intel Corp.	$2,195	Full length	16	Turbo board	●	●	○	●	120

●—Yes ○—No
N/A—Not applicable, does not have memory caching
*Small printed circuit board that plugs into an 80286 socket.

386 machine as a fast 286 machine.

On the other hand, the 386 has attracted a lot of attention from software developers. Products such as Software Link's *PC MOS/386*, Softguard's *VM-386*, Quarterdeck's *DESQview*, Version 2.0, and *Microsoft Windows/386* allow you to use the 386's multitasking capability, and several software vendors have announced special 386 versions of their products that either run faster by using the 32-bit instructions or make use of memory beyond the 640K DOS limit.

MOVING UP There are basically four ways to join the 386 brigade. You can replace your current PC with a Compaq Deskpro 386, PC's Limited 386-16, or other 80386-based extended AT; replace your computer with an IBM PS/2 Model 80; replace your computer's motherboard with one of the 386 motherboards now coming to market; or upgrade your PC AT with a 386 add-in board like one of those reviewed here. (See "Fast Machines, Tough Choices" for guidance in the decision-making process.)

At this writing, some 13 companies have announced 386 add-in boards, mostly for ATs, but only 4 were prepared to provide them to PC Labs for testing. These boards range in price from $495 to $2,195.

Once you've chosen to go the add-in route, you still have several decisions left to make. Some of the add-in boards provide minimal, if any, speed improvement, and some will give you performance twice that of an 8-MHz PC AT. If, on the other hand, what you're looking for is an OS/2 engine or you want to run *DESQview*, Version 2.0, to multitask, compatibility is a more important consideration than speed.

With 386 products, as with any new technology, you must be a careful consumer. Ask the vendor if the product you're looking at will run the software you intend to use. Ask if it will run OS/2. Ask him to prove it. If you're planning to run OS/2 or one of the current 386 multitasking programs, look carefully at the amount of memory you can use and the speed with which you can access it.

These four products at first glance look very similar, but on close examination, they are very different.

AMERICAN COMPUTER AND PERIPHERALS INC.

American 386 Turbo

If you think the primary purpose of a 386 add-in board is to speed up your AT, then the American 386 Turbo may be for you. This $1,699 board, from American Computer and Peripherals, almost doubles the speed of your AT; and since it uses the 286 socket on your AT to control the system, it can take advantage of any other extended memory in your system.

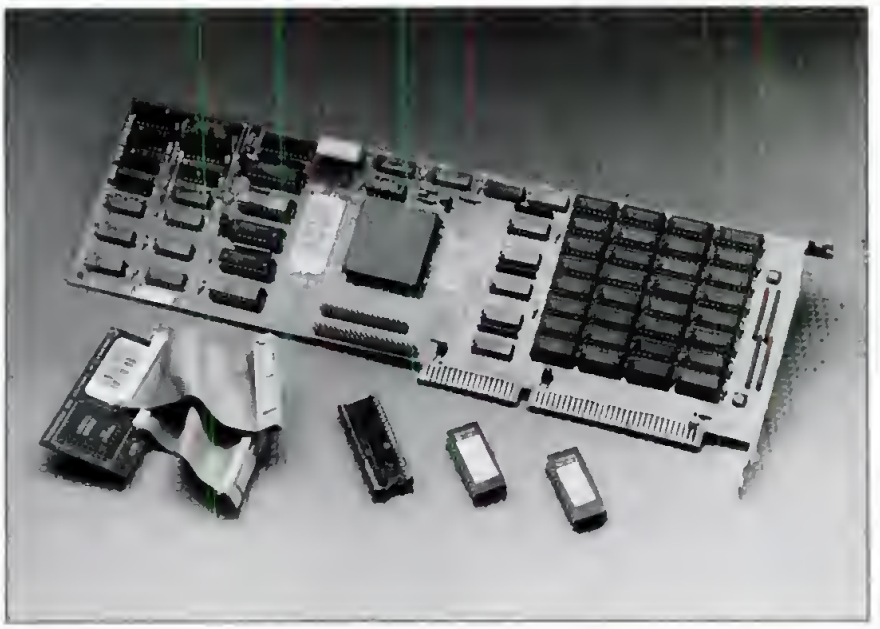
The 386 Turbo has 1 megabyte of 32-bit memory that American calls a 100 percent hit rate cache. What it means by this is that its software copies DOS, your system's ROM BIOS, and EGA ROM BIOS into the cache and then uses these copies to speed up processing. The 386 Turbo comes with a set of Phoenix 386 ROM BIOS chips to make it work better with clones that may have BIOSs that are not perfectly IBM compatible.

Installing the 386 Turbo was an adventure. After removing the hard disk and disk controller from the AT to reach the 80286

FACT FILE

American 386 Turbo
American Computer and Peripherals Inc.
2720 Croddy Way
Santa Ana, CA 92704
(714) 545-2004
List Price: $1,699
Requires: 80286-based system.
In Short: A fast 386 add-in board with only 1Mbyte of RAM and an error in the section of the manual that tells about installation.

CIRCLE 867 ON READER SERVICE CARD



An adapter (left) plugs into your computer's 80286 socket, and two cables connect to the American 386 Turbo board. Two Phoenix 80386 ROM BIOS chips (right) are needed with noncompatible clones. An 80287 adapter (center left) plugs into the math coprocessor socket.

and prying the 80286 out of its socket (no mean feat with 68 pins clinging tenaciously), I installed the 386 Turbo's adapter board into the 80286 socket. The fun began as I tried to connect the two very short ribbon cables to the headers on the bottom part of the 386 Turbo. This was complicated by the fact that in our AT, the 80286 socket didn't quite line up with the headers, which put a small but annoying twist in the cable. After a little swearing and some loss of skin to the inside of the AT, I got everything hooked up. Then I installed the 287 Socket Adapter, which you place in your system's 80287 math coprocessor socket if you don't have an 80287, and turned on the system. Nothing happened.

MANUAL ERROR Fearing that I had just destroyed my AT, I called tech support and was told *I* was doing everything right. They confirmed that the Turbo 386 should be jumpered for slow mode and would later run a program to switch it to fast mode. After more swearing and some trial and error, I discovered that the manual and the tech support department were wrong. If I set the board for its fast mode with the onboard jumpers, it worked just fine.

I then ran the programs that set the clock to fast speed, enabled the cache, copied my ROM to the cache, and set the EGA for fast operation. There are separate versions of these utilities for each setting of the speed jumpers, and they must be run in the right order. American should just write a single program that either asks you what you want or reads the speed jumpers and hardware configuration and does it automatically.

The 386 Turbo ran every program I threw at it except a beta-test version of OS/2. American claims the 386 Turbo will run Novell's *NetWare* to speed up your file server. Of course, file servers benefit most from faster hard disks. But the extra processing power can't hurt.

I also didn't get to test the performance of the board with programs that used more than 1 megabyte of memory. I assume that they run slower than smaller programs, since the processor must access that memory using the AT's 16-bit bus. I'd like to see American come out with a version of the 386 Turbo that would accept piggyback cards for memory expansion.

In conclusion, the 386 Turbo does speed up your computer, but it has only 1 megabyte of memory and a serious error in its manual.

APPLIED REASONING CORP.

PC-Elevator 386

Applied Reasoning's PC-Elevator 386, which lists for $1,995, is the only board tested that works with sub-AT-class PCs. You can install the PC-Elevator 386 in your PC, XT, or clone just by sticking it in any available slot. You don't have to remove the old processor or hook up any cables.

The PC-Elevator 386 is a well-constructed board that includes 1 megabyte of 32-bit interleaved RAM (expandable to 5 megabytes with a piggyback card due to be released soon), a 16-MHz 80386, and an 80387 socket.

After the incredibly simple hardware installation, you run Applied Reasoning's Setup program, which copies the required programs to your boot disk and modifies your CONFIG.SYS file. You spend a few seconds editing your AUTOEXEC.BAT, then reboot, and you're up and running.

Once you have the system set up, all you have to do is run the Up program to run your software on the 386 or Down to run timing-sensitive programs on your old processor. If you forget where you are, you can just run Level.

FASTER THAN COMPAQ Our benchmark tests show that the PC-Elevator 386 is even a little faster than the Compaq Deskpro 386. Disk I/O is unfortunately a little slower than that of your host computer, since the PC-Elevator 386 has to ask your host to get disk data and wait for it to pass it back.

The PC-Elevator 386 talks to the host processor through a block of dual-port memory and a block of I/O ports. This design, combined with the software necessary to load software into the 386, prevented the PC-Elevator from running a beta-test version of OS/2. Applied Reasoning says that it plans to license OS/2 from Microsoft and develop drivers specifically for the PC-Elevator 386.

Applied Reasoning is also developing memory utilities that will allow you to use part of the memory on the board as EMS memory and part as a disk cache to speed up disk I/O. The architecture of the PC-Elevator 386 makes it attractive for some special OEM applications. Since the I/O

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Microbuffer Inline *(par. print buffer w/256k)* 149.
Princeton Graphics ... 1 year
MAX-12E Amber monochrome monitor ... 179.
HX-12E *(EGA compatible)* 499

Toshiba ... 1 year
P321SL printer *(80 col., 216 cps, w/tractor)* $529.
P341SL printer *(132 col., 216 cps)* ..... 739.
P351 S/P printer Mod 2 *(136 col., 288 cps)* 939.
T1000 Laptop Computer ..... call
T3100/20 Laptop *(w/20 Meg Hard Drive)* ... call
Tseng Labs ... 1 year
EVA 480 *(supports 640x480 res., includes Dr. Halo II & drivers for Autocad & Lotus 1-2-3)* .. 319.
Video 7 ... 2 years
VEGA Deluxe *(supports 640x480)* ..... 319.

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IOMEGA ... 1 year
Bernoulli Box 20 Meg w/PC2 card ..... 1549.
10 Meg cartridge ..... 57.
Bernoulli Box 40 Meg w/PC2 card ..... 1849.
20 Meg cartridge ..... 79.
PC2B (Bootable) Card ..... 249.
Mountain Computer ... 1 year
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40 Meg Micro Mountain External Tape Drive *(XT or AT)* ..... 499.
DriveCard 20 Meg *(80 ms)* ..... 479.
DriveCard 30 Meg *(78 ms)* ..... 569.
40 Meg External Tape Drive w/Power Supply *(for XT or AT)* ..... 599.
DriveCard 50 Meg *(54 ms)* ..... special
Seagate ... 1 year
FREE PCTV® Hard Drive Installation Tape with the purchase of either of the following Seagate drives for the IBM PC (not for AT). Specify Beta or VHS.
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30 Meg Internal Hard Drive *(w/Adaptec RLL controller and cables, 65 ms)* ..... 339.
AT 30 Meg Internal Hard Drive *(w/cables & instructions, 39 ms)* ..... 589.
TEAC ... 1 year
PC, XT 360k Drive *(5¼" half-height)* ..... 109.
Toshiba ... 1 year
PC, XT 360k Drive *(5¼" half-height)* ..... 109.
AT 360k Drive *(5¼" half-height)* ..... 117.
3½" Internal ND-354-A Disk Drive *(720k)* .. 119.
Miniscribe Corp. ... 1 year
ScribeCard 20 Meg *(68 ms)* ..... 459.
ScribeCard 30 Meg *(68 ms)* ..... 479.

MEMORY

64k Upgrade Set *(150 ns, set of 9)* ..... call
256k Upgrade Set *(150 ns, set of 9)* ..... call
256k Upgrade Set *(120 ns, set of 9)* ..... call

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Maxell MD2-DM *(10 disks per box)* ..... 15.

DS/High Density Disks for the AT (96 TPI).
Fuji MD2HD *(10 disks per box)* ..... 24.
Maxell MD2-HDM *(10 disks per box)* ..... 27.
Verbatim Datalife *(10 disks per box)* ..... 27.

3½" Double-sided Diskettes *(720k)*
Sony *(10 disks per box)* ..... 21.
Maxell *(10 disks per box)* ..... 23.

3½" High-Density Diskettes *(1.44 Meg)*
Fuji *(10 disks per box)* ..... 55.
Maxell *(10 disks per box)* ..... 59.

MISCELLANEOUS

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CompuServe Information Service ..... 24.
Grolier's OnLine Encyclopedia ..... 32.
PC Connection
Computer Toolkit ..... 22.

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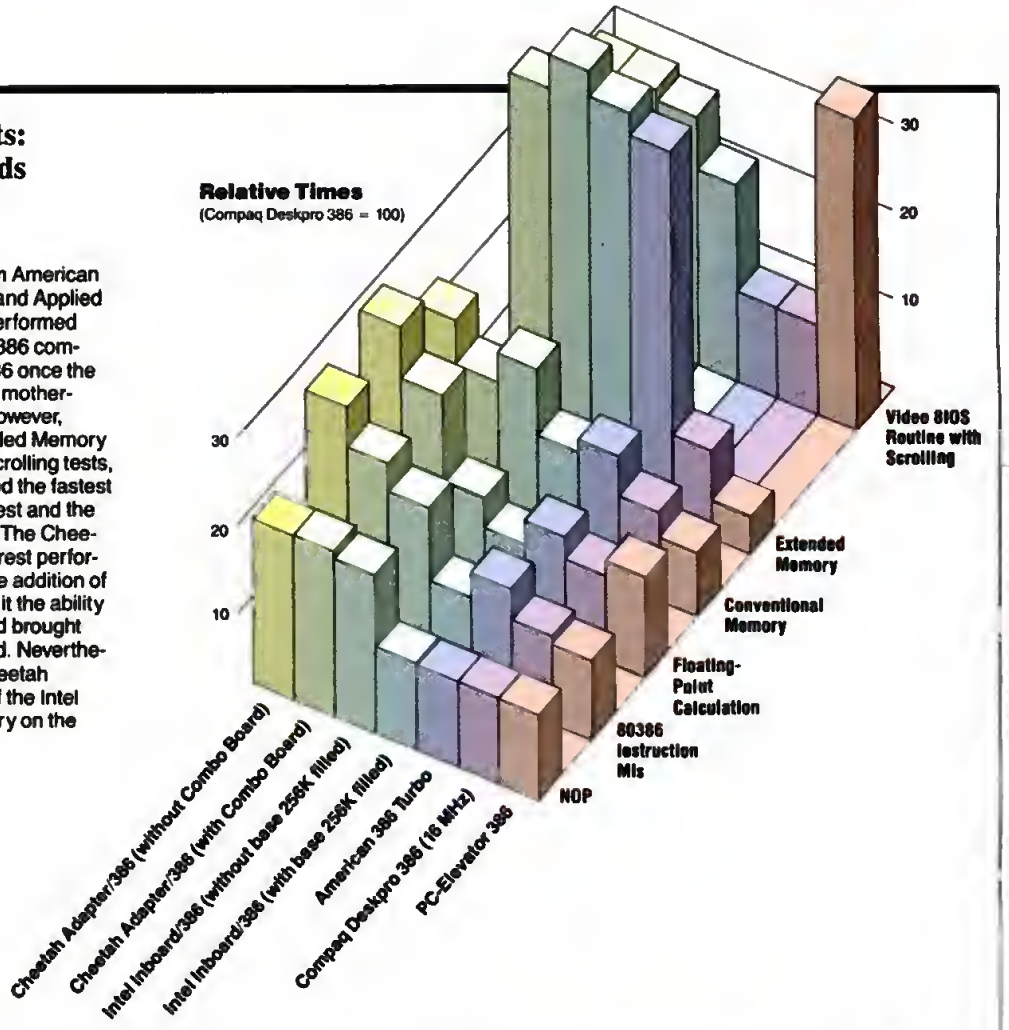
Benchmark Tests: 386 Turbo Boards

The American 386 Turbo, from American Computer and Peripherals, and Applied Reasoning's PC-Elevator 386 performed most like the Compaq Deskpro 386 computer, as did the Intel Inboard/386 once the 256K-byte base memory on the motherboard was filled. The Inboard, however, posted slow times on the Extended Memory and Video BIOS Routine with Scrolling tests, while the PC-Elevator 386 posted the fastest time on the Extended Memory test and the slowest on the Video BIOS test. The Cheetah Adapter/386 posted the poorest performance on our tests, although the addition of the optional Combo Board gave it the ability to access extended memory and brought marginal improvements in speed. Nevertheless, the performance of the Cheetah Adapter/386 was close to that of the Intel Inboard/386 before base memory on the Inboard was filled.



Performance Times
(Times given in seconds)

	NOP	80386 Instruction Mix	Floating-Point Calculation	Conventional Memory	Extended Memory	Video BIOS Routine with Scrolling
Cheetah Adapter/386 (without Combo Board)	4.0	11.3	44.1	1.6	N/A	15.7
Cheetah Adapter/386 (with Combo Board)	4.0	9.3	35.4	1.3	12.7	15.7
Intel Inboard/386 (without base 256K filled)	3.8	8.0	20.0	1.5	13.8	14.9
Intel Inboard/386 (with base 256K filled)	2.1	4.5	14.9	1.0	13.0	11.8
American 386 Turbo	2.1	5.8	19.2	1.1	12.2	5.4
Compaq Deskpro 386 (16 MHz)	2.1	4.2	15.5	0.7	2.9	5.3
PC-Elevator 386	2.1	3.9	18.2	0.5	1.2	18.8

N/A—Not applicable; does not access extended memory without optional Combo Board.

The **NOP** benchmark test is designed to measure raw clock speed and memory access time while minimizing differences in microprocessors and the effect of memory caching. This test executes almost nothing but NOP ("No Operation") machine code instructions in a big 128K loop.

The **80386 Instruction Mix** benchmark test measures the time it takes to execute a selected series of processor-intensive tasks. The test program uses 80386 instruction code. These instructions are a subset of the total processor instruction set. The 80386 instruction mix implements a number of 32-bit operations. In the 80386 processor these become single instructions, whereas in the 8086 and 80286 versions of the benchmark test they remain multiple instructions.

The **Floating-Point Calculation** benchmark test measures processor speed by looping through a series of floating-point calculations, including multiplication, division, exponentiation, and logarithmic and trigonometric functions. The benchmark program uses the floating-point library included with Microsoft C Compiler 4.0.

The **Conventional Memory** benchmark test allocates 256K bytes of conventional memory and treats it as a series of 64-byte records. Then, 16,384 random records are read into and written from this memory.

The **Extended Memory** benchmark test allocates 256K bytes of extended memory and treats it as a series of 64-byte records. Then, 16,384 random records are read into and written from this memory.

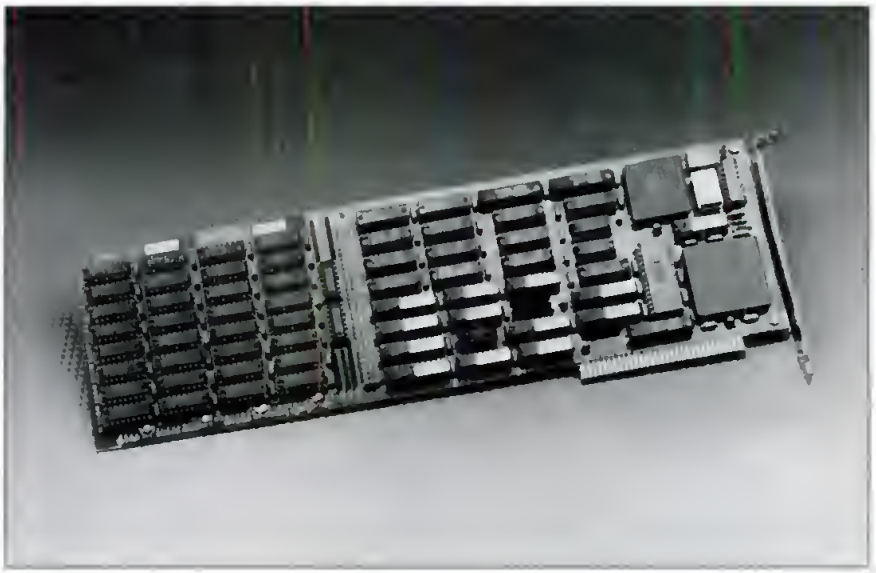
The **Video BIOS Routine with Scrolling** benchmark test measures the speed of the BIOS Teletype routine with scrolling. The test is performed in video mode 3. The screen is cleared and 240 lines of 80 characters each (including a terminating carriage return and line feed) are written to the display through the BIOS Teletype routine. Although the first 24 lines written to the display do not involve scrolling, all the remaining lines scroll the display.

FACT FILE

PC-Elevator 386
Applied Reasoning Corp.
86 Sherman St.
Cambridge, MA 02140
(617) 492-0700
List Price: $1,995
Requires: IBM PC, XT, AT, or true compatible.
In Short: Easy to install and fast, this is the only board reviewed that works on sub-AT class PCs.
CIRCLE 666 ON READER SERVICE CARD

and memory addresses for the PC-Elevator 386 are switch selectable, you could, with some custom software, install three or four PC-Elevator 386s and have the host processor poll them for data.

The PC-Elevator 386 is an interesting choice in this first generation of 386 add-in boards. Its speed and ease of installation are attractive, and it's the only one that works on either a PC or an AT.



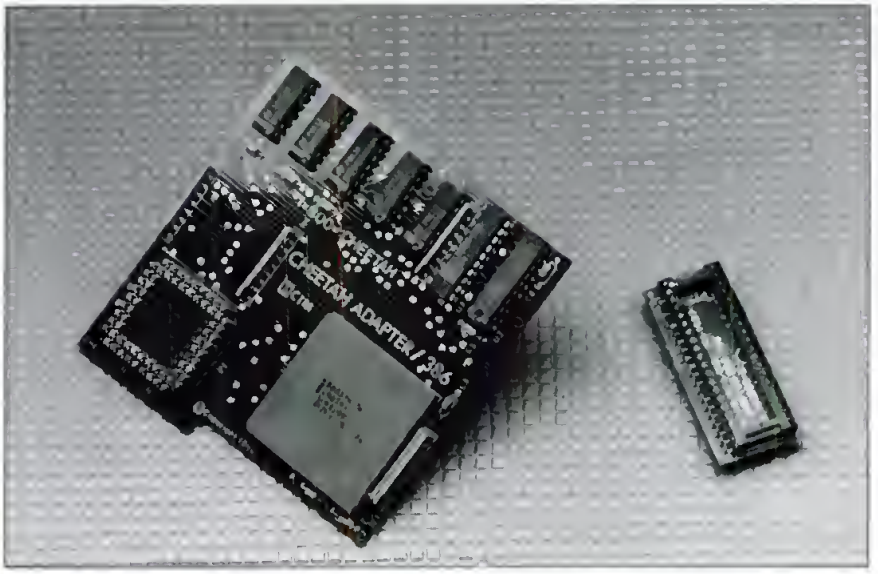
The PC-Elevotor 386 con be installed in any available slot of o PC, XT, AT, ar clane withaut gaing thraugh the hassle af remaving the old processor ar attoching cobles. The turbo board includes 1 megobyte of 32-bit interleaved RAM.

CHEETAH INTERNATIONAL INC.
Cheetah Adapter/386

The Cheetah Adapter/386—which at $495 is the least expensive that we reviewed—represents the minimalist school of 386 board design. Measuring just 3½ inches square, the entire Adapter/386

FACT FILE

Cheetah Adapter/386
Cheetah International Inc.
107 Community Blvd., #5
Longview, TX 75602
(800) 243-3824
(214) 757-3001 (in Tex.)
List Price: With 80386 chip, $495; without chip, $195; adapter for leadless chip carrier 80286s, $75.
Requires: IBM PC-XT Model 286, AT, or true compatible.
In Short: A simple PC board that costs you speed but adds 80386 multitasking and instructions to your AT. The least expensive of those we reviewed.
CIRCLE 665 ON READER SERVICE CARD

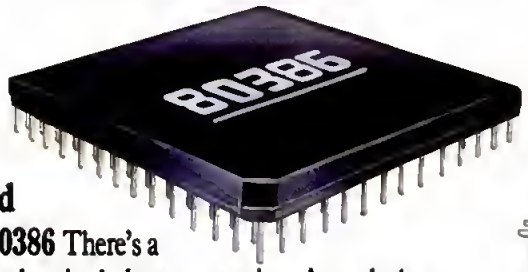


The Cheetah Adapter/386 plugs right into the 80286 socket an the matherboard af your AT compatible. If your camputer has a math coprocessor, you will need to reploce the coprocessor with the 80287 adapter (right).

plugs into the 80286 socket on the motherboard of your AT or compatible. The Adapter/386 then allows you to run *DESQview*, Version 2.0, or any other 80386-specific software on your AT.

Installing the Adapter/386 in a real IBM PC AT is simple if a bit hard on the knuckles. First you remove the disk controller and slide your hard disk out so you can get at the 80286. Then you pry the 80286 out of its socket. With 68 pins in the socket, it takes more than a little work to get it out straight. Insert the Cheetah board, replace the crystal with the 17-MHz crystal Cheetah provides, and go. If you have an 80287 coprocessor, you'll have to pull it out and

A Number of Reasons A Number

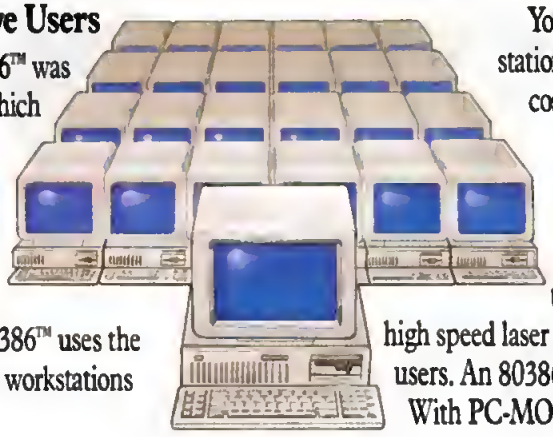


1. Designed for the 80386 There's a revolution taking place in desktop computing. A revolution that's been launched by a square wafer of silicon known as the 80386 microprocessor chip. It puts minicomputer potential at PC users' fingertips. It's a fact that virtually every leading PC manufacturer has built a "box" around this chip. And it's a fact that the "New Operating System" will, supposedly, even run on it. But, it's also a fact that *their* system wasn't designed for the 80386. Ours is. And it's called PC-MOS/386™.

2. PC and PS/2 Compatible In designing PC-MOS, we knew our first priority was to exploit the minicomputer capabilities of 80386-based PCs & PS/2s. But we went further, and developed a system which would be fully compatible with the millions of existing PCs, PC ATs, and PC-compatibles. Power without sacrifice. You'd expect nothing less from the new standard bearer.

3. One, Five, Up to Twenty-five Users From the beginning, PC-MOS/386™ was designed as a versatile operating system which could support twenty-five users as easily as it supports one. The system comes in single, five, and 25-user modules, so you're able to start with what you need and expand when you're ready.

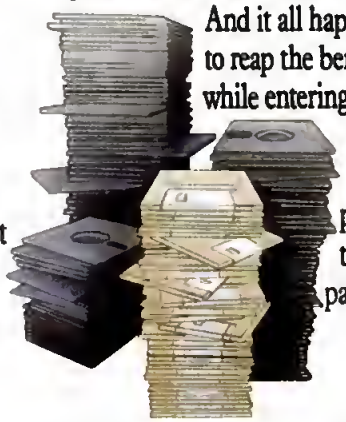
In a multi-user setting, PC-MOS/386™ uses the computing power of the host PC to drive workstations linked to standard RS-232 ports.



You can choose from a variety of workstations. Mix and match dumb terminals costing under $500 each with PCs and PS/2s running our terminal emulation software.

All of the host's resources can be shared. Programs, data, hard disks, tape backup units & printers (including high speed laser printers) are suddenly available to all users. An 80386-PC has minicomputer potential. With PC-MOS/386™ you can "mini" your micro.

4. Thousands of DOS Programs PC-MOS/386™ gives you the best of the past, and the best for your future. Which means that while PC-MOS/386™ totally replaces your old DOS, you won't have to replace the programs you've spent a lot of time learning.



And it all happens so effortlessly. You'll continue to reap the benefits of your favorite DOS programs, while entering a new arena of power.

Think of it! Programs like dBASE III, WordPerfect, Lotus 1-2-3 and Symphony, WordStar, MultiMate...literally thousands of DOS programs–all compatible and multi-user available.

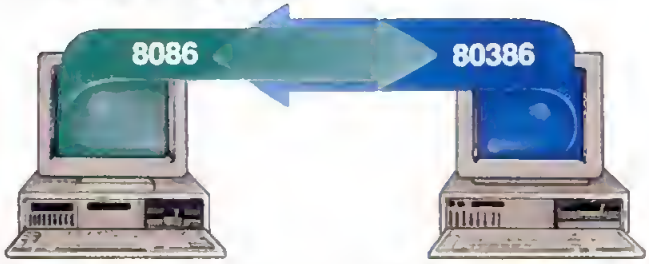
5. Familiar Commands Like DIR and COPY

Just as you don't have to learn a whole new array of software to take advantage of PC-MOS/386™, neither do you have to learn an entirely new set of commands.

Instead, the system builds on the knowledge you already have. "COPY" still copies files, and "DIR" still gives you a directory listing. As you might expect, we didn't stop there. There's a wealth of features that have strengthened the commands you know, making them more powerful and easier to use.

# of Users Will Choose PC-MOS/386.™

6. Concurrently Supports Virtual 8086 and 80386 32-Bit Mode



80386-based PCs & PS/2s are dual-personality computers. To run DOS programs, they act as PCs with a 640K memory limit. But to take advantage of their minicomputer capacity, they operate in true 80386 mode which lets them address up to four gigabytes of memory. PC-MOS enables the 80386-host and its workstations to independently switch between these modes–making DOS compatibility and 80386 power simultaneously possible.

7. Multi-Tasking

While it's true you could look elsewhere for multi-tasking, why would you want to? The *other* multi-tasking operating system is not now, nor is it planned to be, multi-user. It won't even run multiple DOS applications in multi-tasking mode.

Now consider PC-MOS/386.™ At the touch of a key, you can switch between up to 25 different tasks. And if you have workstations connected to a host, they get multi-tasking, too. Finally...a system that won't hold you back.

8. File/Record Locking and Security

When you decide to implement either a network or a multi-user system, there's a two-fold problem which must be solved: protecting your work from accidental misuse and securing it from intentional theft. PC-MOS/386™ solves both aspects of this problem. Password protected security allows you to assign file, directory, and task access to each user. Plus, files and records are locked using either PC-MOS' proprietary system or NETBIOS emulation.

9. Remote Access

It's been said that information is power...which makes PC-MOS/386™ a deadly weapon to your competition. Imagine on-the-road salespeople being able to file call reports and access your latest inventory data. Picture executives being able to access your corporate database from across the country, or around the world–giving them the information they need, when they need it.

Visualize branch offices tapping time-critical data with nothing more than a modem and a workstation. Working at a home office in the evening or over the weekend suddenly gets awfully productive. And that makes good business sense. The kind of sense you can't afford to be without.

10. The Price...

As you evaluate operating systems, ask yourself if it's reasons you're considering...or rhyme. Ask if you're getting a system for tomorrow, or one that was made for yesterday. See if you're being forced to buy new hardware because of *their* software. And consider this.

Only one operating system in the world can give you the raw power, features, and functionality that you demand. Its name is PC-MOS/386.™ And it's immediately available in one, five and 25-user versions starting at $195.

PC-MOS/386™ is a trademark of The Software Link, Inc. PS/2, PC AT, NETBIOS, dBASE III, MultiMate, WordPerfect, Lotus 1-2-3 & Symphony, & WordStar are trademarks of IBM Corp., Ashton-Tate, WordPerfect Corp., Lotus Development Corp., & MicroPro, respectively. Prices and technical specifications subject to change. Copyright ©1987. All Rights Reserved.

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Fast Machines, Tough Choices: 80386 Decision Guide

If cost is no object and you can efford to wait a few weeks, go out and buy one of IBM's or Compaq's new 20-MHz machines. The Model 80's only drawbecks are its cost and the lack of special-purpose add-in cards for the Micro Chennel.

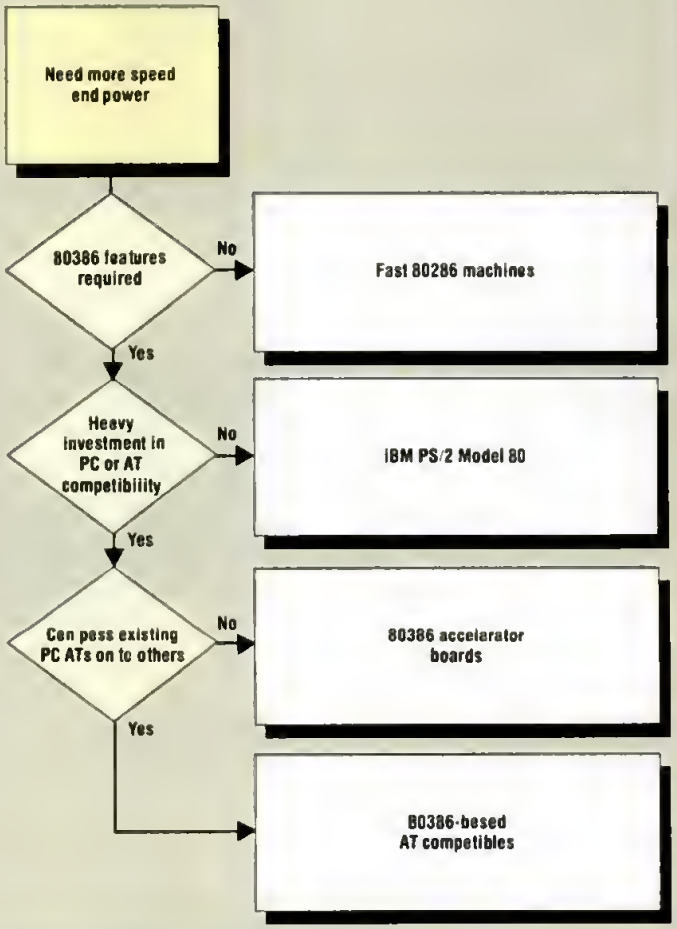
If it's possible for you to be happy with a mere 16 MHz, consider selling your existing PC and buying a new 386-based extended AT such as the Compeq Deskpro 386, Tendy 4000, ALR 386/2, or PC's Limited 386-16. Prices on these machines range from around $2,000 for a stripped 1-megabyte machine with one floppy drive to more then $7,000 for a system with EGA and a 130-megabyte hard disk. Figure in the resale value of your current system, and you cen upgrade from en AT for es little as $1,000.

If the thought of getting rid of your trusty steed makes you break out in e cold sweet, you could keep your old familier system and swap its motherboerd for a 386-based one. Intel, Cheetah, Hauppauge Computer Works, end others meke replacement 386 motherboards for ATs or XTs for $1,000 to $2,000.

Intel's motherboard, widely used by menufacturers of low-cost 386 machines, is considered an OEM product, not an end-user product. This means that Intel will not provide direct support to you if you buy a motherboard from one of its OEMs. Early revisions of the motherboard are also not competible with the 80387 math coprocessor, end our testing indicates that these eerly revision boards are not compatible with OS/2. Ongoing revisions to OS/2 may yet enable it to run on these machines.

Motherboards have an advantage in 32-bit memory expansion capacity, while also retaining your investment in add-in cards, monitors, disk drives, and other peripherals. However, the resale value of a motherboard is significantly less than thet of a whole computer, which offsets any cost advantage the add-in motherboerd hes over a full replacement system. One other advantage is that your computer will still have en IBM case. I know of at least one large financial institution where en IBM case without a single IBM board is an allowable system but an ALR 386 is not.

—Howard Marks



stack it in the adapter board provided.

Some clones don't have enough clearance to install the Adapter/386 without its shorting into the disk drive cage. If your machine has the 80286 in a leadless chip carrier (LCC) like the Compaq Portable II does, you'll need an adapter cable from Cheetah that will set you back another $75. If your computer's 80286 is under a little aluminum door, then it's in an LCC.

Once you have it installed, you'll find that what the Adapter/386 doesn't do is speed up your computer. In fact, our benchmark tests show a small decrease in computer performance.

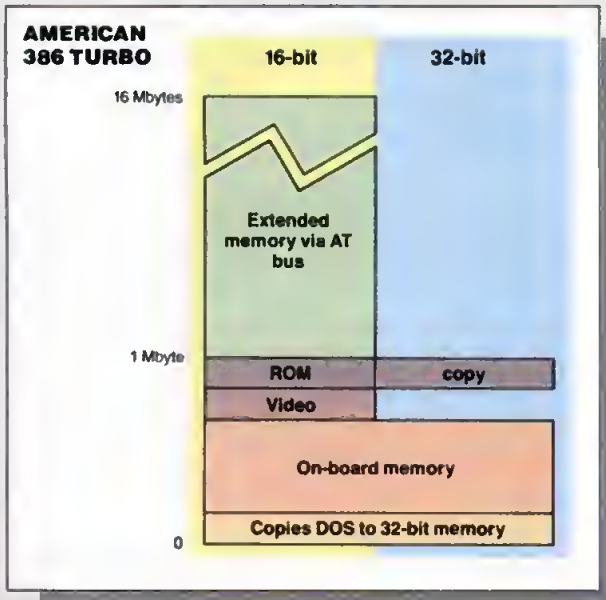
■ The Cheetah Adapter/386 represents the minimalist school of 386 board design.

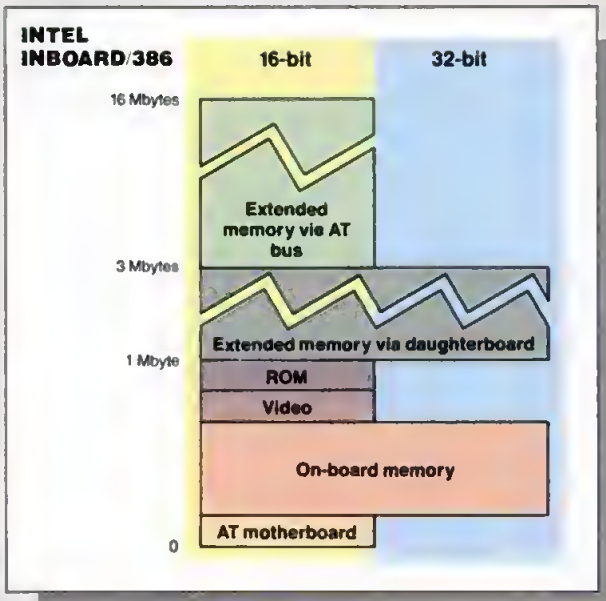
Cheetah feels that most people are pleased with the performance of their ATs and don't have a burning need for more speed. What it feels you do need is multitasking. Of course, if you start running four tasks and they are each running one-quarter as fast as they used to before you installed the Adapter/386, you might just develop that burning need.

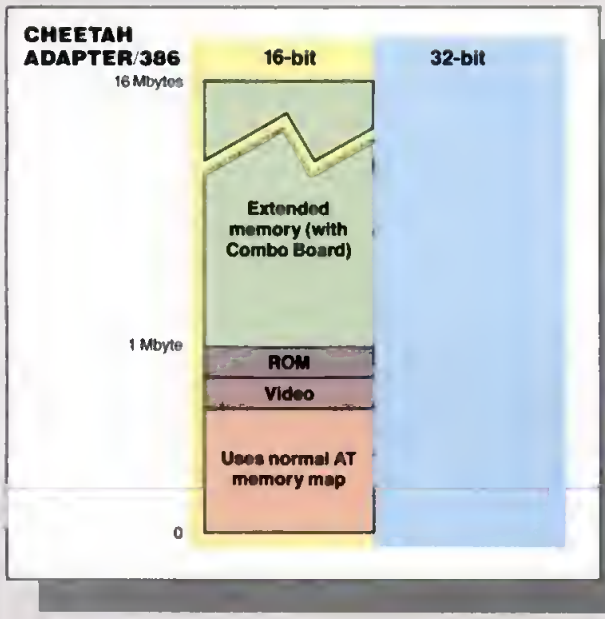
The Cheetah Adapter/386 is a simple, low-cost way to run 386 software without any speed increase. If that's what you want and $495 seems a reasonable price, then the Cheetah is for you. Personally, I think if I'm going to spend any money on a 386, I want it to be a fast 386.

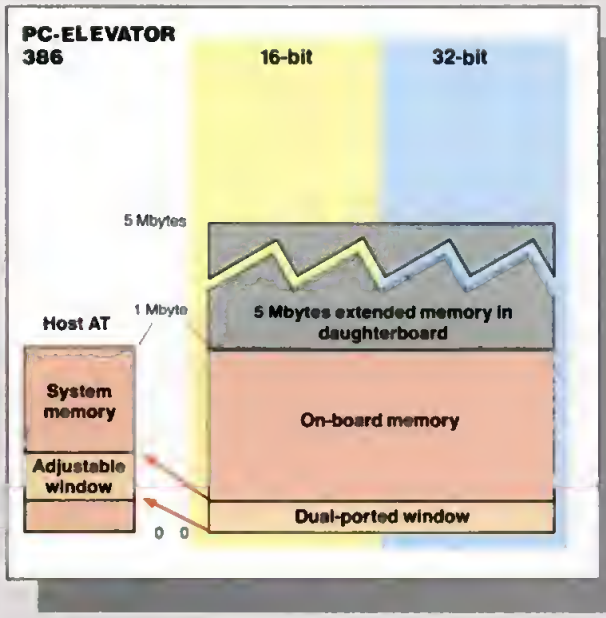
Mapping the Memory of 386 Accelerators

The memory maps of the 80386 add-in boards show the wide variety of approaches to enhancing an AT. Some approaches trade compatibility for speed. Others open the door for multiprocessing.









INTEL CORP.

Intel Inboard/386

I must admit I'm a bit disappointed in the Intel Inboard/386. I expected double AT speed, full compatibility, and truly impressive engineering. After all, this board is from the same guys who designed the 80386. What I got was limited compatibility, impressive packaging, and an improvement in speed that was sometimes double AT performance at a list price of $2,195.

The Inboard is a full-slot card with the 80386 processor and sockets for an 80387 math module and 1 megabyte of 32-bit memory. An optional piggyback board can hold another 2 megabytes of RAM. The Inboard also includes software for selecting system speed, using Inboard memory to emulate expanded memory (EMS), and creating a RAMdisk.

The Inboard is actually sold as two separate products: the $1,995 Inboard itself and a $200 installation kit that includes the cable required to connect your Inboard to your computer's 80286 socket. Intel has cables for both the PGA (pin grid array) package used in IBM's 80286 AT, and the LCC (leadless chip carrier) package for 80286s used in Compaq and some other compatible machines.

To find out which cable you need, open your computer and find the 80286 chip. If you can see the chip itself inside your computer, you have the PGA package. If your 80286 is held into the socket with a clamp on a little aluminum door, you are the proud owner of an LCC.

PC MAGAZINE FACT FILE

Intel Inboard/386
Intel Corp.
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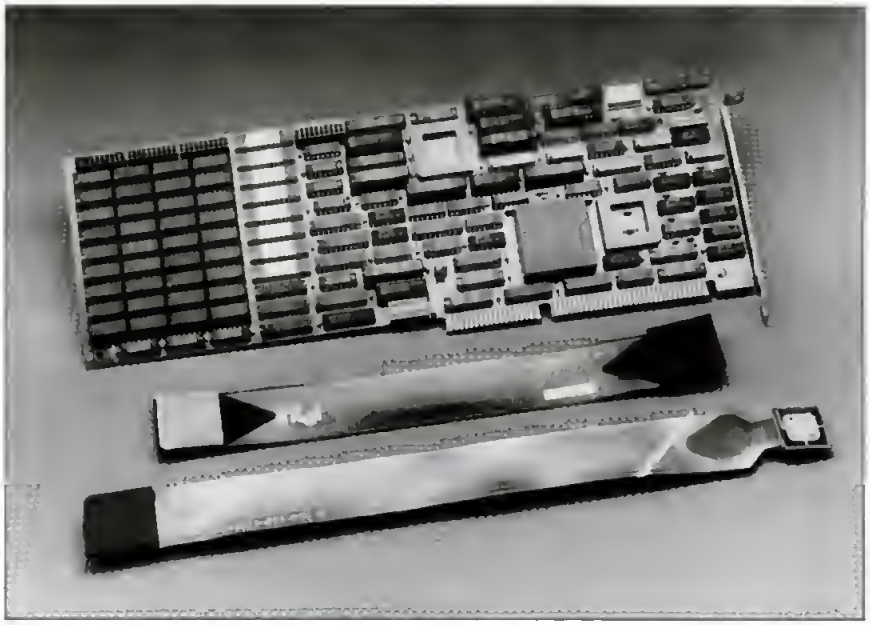
Hillsboro, OR 97124
(800) 538-3373
(503) 629-7354 (in Oreg.)
List Price: $2,195 (including installation kit); with 1 Mbyte of additional memory, $2,695.
Requires: IBM AT compatible.
In Short: A well-engineered card for the AT. Provides a small speed increase.

CIRCLE 664 ON READER SERVICE CARD



Intel's Inboard/386 has an installation kit, sold separately, that includes cables for both the pin grid array package used in the IBM AT (top) and the leadless chip carrier package used by Compaq and some other compatibles (bottom).

Once you get the Inboard home, you have the adventure of installing it in your AT. Intel provides a 100-page manual with step-by-step instructions for installing the Inboard in IBM, Compaq, and Tandy computers and a pamphlet called *Recent News About the Inboard/386*. It includes manual corrections and the news that even though the manual has instructions for installing the Inboard in a Compaq Portable II, the board won't work. Intel even provides a chip puller for the PGA 80286, which is very difficult to remove with the usual screwdriver. Make sure you have only the chip and not the socket in its little jaws, however, as you could do serious damage to your motherboard by ripping out the socket.

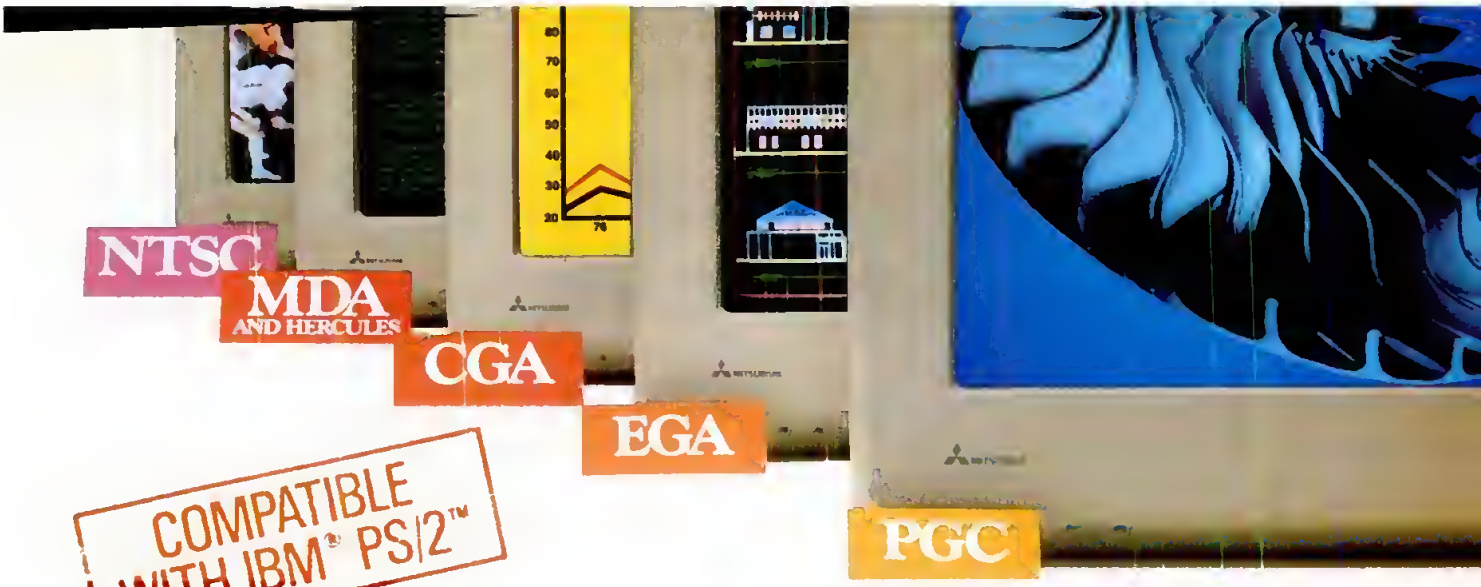
Unfortunately, the section on setting the Inboard switches was about the most confusing I've seen in years. First you have to figure out how much extended memory will be in your machine after you install the Inboard and set a bank of switches. Then you get to figure out how much of the Inboard's memory is to be extended. Intel includes a worksheet, but it doesn't help much. Examples are provided for all but the most-common cases. After several attempts, I called tech support.

TELEPHONE HASSLES Intel has what must be the world's most obnoxious call-routing system. After you call the 800 number, thoughtfully printed on a label on the board's antistatic bag, you reach a computer controlled system that asks you to press 1 for customer service, 2 for tech support, and so on. If you don't have a Touch-tone phone, a human operator picks up in about 30 seconds.

If, however, you press 2 and there is no technician available, you get a recorded message that tells you to press 2 to try again, or it will say goodbye in 10 seconds. So while you wait, you have to keep pressing 2 every 20 seconds or get hung up on. I finally gave up and pretended I didn't have a Touch-tone phone, so I could give my finger a rest.

Once I got the Inboard installed, it worked fine, running any software I threw at it, including OS/2. Our benchmark tests showed a speed improvement of 15 to 100 percent, depending on the test.

Intel made a tough decision in the board's design. For maximum compatibility, it wanted to use the IBM ROMs. Having done that, it was pretty much stuck with a minimum of 256K bytes of IBM's slow system board RAM. Programs that



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CIRCLE 293 ON READER SERVICE CARD

PC MAGAZINE EDITOR'S CHOICE

All were interesting, but none were perfect. Applied Reasoning Corp.'s PC-Elevator 386 was the most impressive of the boards tested. It ran the PC Labs benchmark tests somewhat faster than the Compaq Deskpro 386, was easy to install, and was the only board tested that would run in an XT-class machine. The Intel Inboard/386 and the Cheetah Adapter/386 sacrifice speed for compatibility, although the Inboard/386 has speed potential well beyond that of the Cheetah Adapter/386. They both deliver the 386's most obvious advantage. And American Computer and Peripherals' 386 Turbo can address only 1 megabyte of memory, giving up capacity for multitasking.

The PC-Elevator 386's architecture is too different from a normal AT to run OS/2 out of the box, and it reduces disk throughput.

If the approach of adding a turbo board meets your needs and your budget, you may want to move now. But this is a dynamic and fast-changing market. I'd wait.

run in this RAM run noticeably slower than when in the Inboard's math memory. You can actually speed up operations if you first run a memory-resident program such as *SideKick* to burn up memory space on the motherboard. Our benchmark tests are small programs that run in the 256K bytes of 16-bit motherboard RAM as opposed to the 32-bit on-board memory. The results were disappointingly slow. When we filled the 16-bit memory and reran the tests, the machine performed as a 16-MHz 386 should.

The Intel Inboard/386 is unique today in its ability to run OS/2. You will have to decide if that is worth the $2,195 price. PC

Howard Marks is an independent systems consultant and free-lance writer based in New Jersey.

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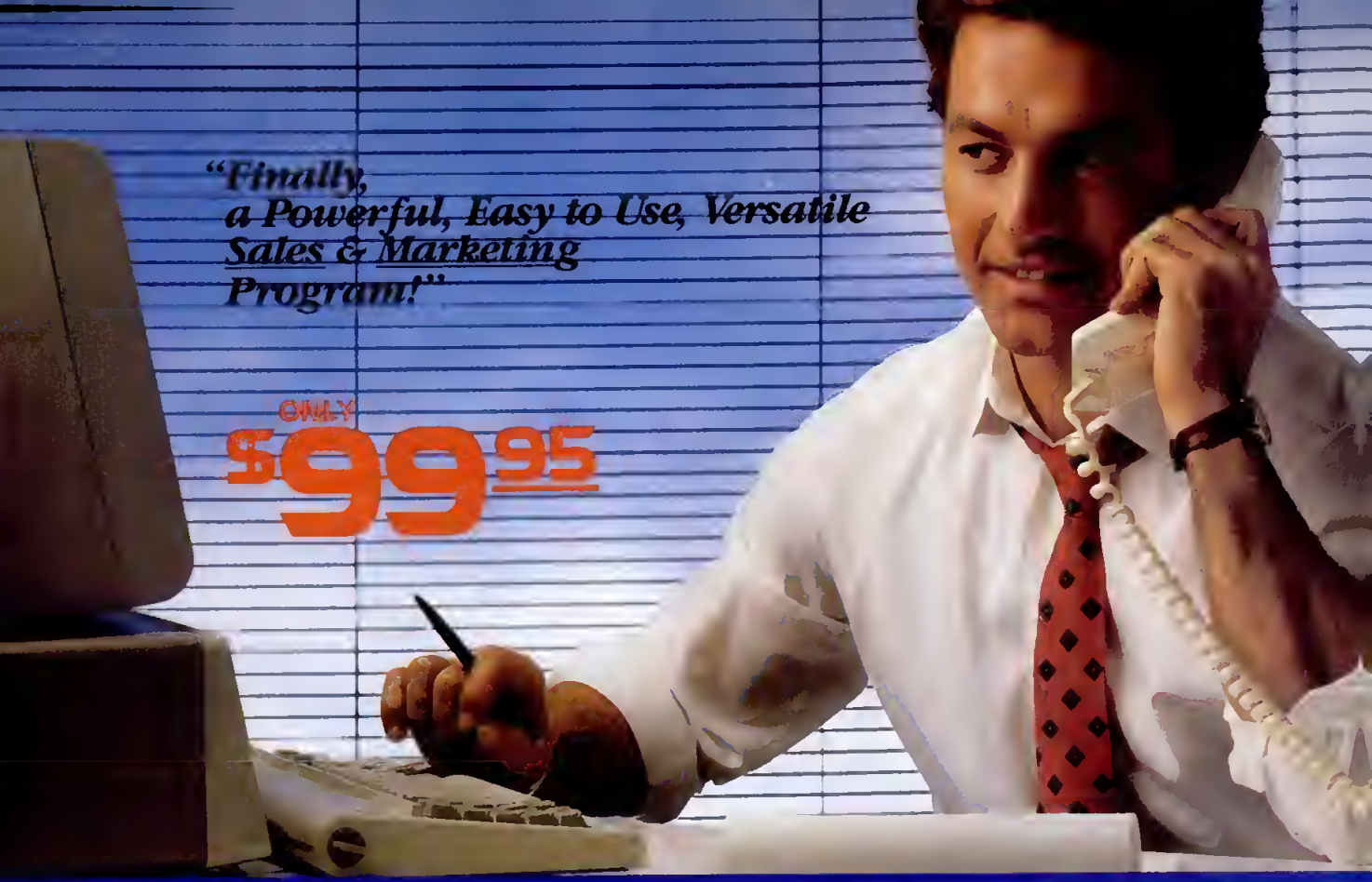

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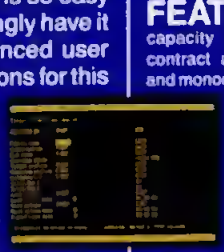

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VOICE RECOGNITION: UNDERSTANDING *the* MASTER'S VOICE

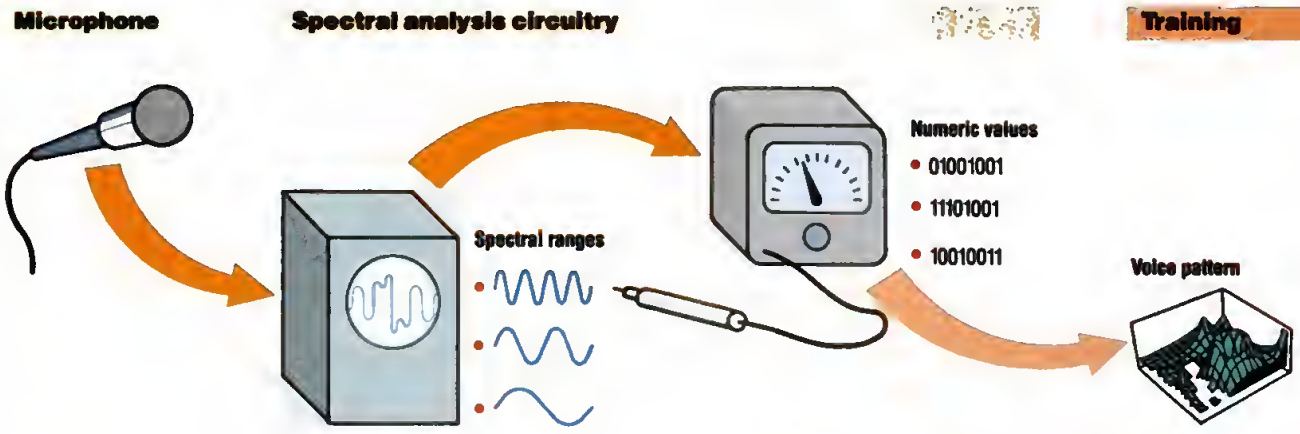
Imagine the ultimate computerized office. A PC takes the place of your secretary, taking dictation and then turning the spoken words into ASCII text files, complete with punctuation and capitalization.

But this reverie is a reality. Two available voice recognizers—the VoiceScribe-1000 from Dragon Systems and the Kurzweil Voicesystem from Kurzweil Applied Intelligence—do just that.

Another voice recognizer, the Voice Developer System from Verbex Voice Industries Corp., actually seems to understand what you're saying. After you teach it a rudimentary grammar system, it will listen to the phrases and sentences and make sure that the words fit your grammatical rules before accepting them and typing them out. It even uses context sensitivity to help it understand ambiguous wording.

Voice-recognition systems have come a long way in the past year. With vocabularies of up to 1,000 words, plus the ability to recognize continuous speech and to understand many voices, some systems might soon replace your secretary for taking dictation.

How Voice Recognition Works



A microphone (or telephone) first picks up the voice.

The voice-recognition board's spectrum analysis circuitry then divides the voice signal into as many as 30 different spectral ranges every few milliseconds.

The spectrum analysis circuitry then measures the intensity of each spectral range separately and assigns a numeric (digital) value to it. Since each voice signal can have up to 30 spectral ranges, it will be assigned as many as 30 numeric values.

The voice-recognition board then combines the results of multiple spectral range measurements from a period of from 0.5 to 3 seconds to make a voice pattern. It stores this voice pattern along with the text that the pattern represents. Because people never pronounce the same words in exactly the same way, most voice-recognition systems require you to record three to five utterances of the same word. Some systems store an average pattern, while others maintain several patterns of each word so that a common vocal variation will find its match.

To get to this point, voice-recognition technology has made great strides in the past year. Where once even the best systems could understand only 50 words, today you can buy 1,000-word—and even 20,000-word—capabilities. Where once you had to leave long pauses between syllables, new hardware makes valiant efforts to understand continuous, conversational-style speech. Some systems even recognize the voices of several people interchangeably.

Even the least expensive equipment achieves recognition accuracies of 98 percent (within vocabulary limits) once both the voice-recognition system and its user have been properly trained. Although not perfect, that error rate is superior to what ordinary human beings achieve when transcribing isolated words over the telephone.

Although no voice-recognition system can replace the stenographer entirely, today's hardware is finding a home in an increasing number of applications. Industrial work and inventory taking remain the leading business applications for simple systems. Medical professionals are using high-end voice recognizers to prepare recurring reports. And, of course, voice recognition has proved to be a tremendous boon to the handicapped.

Increasingly, office workers are supplementing their keyboards with voice recognition, although even the best systems still are not complete keyboard replacements. These systems allow your voice to act as a mouse that needs no desktop, an extended set of function keys, or even a set of full-fledged macros that minimize most of the tedium of your workday.

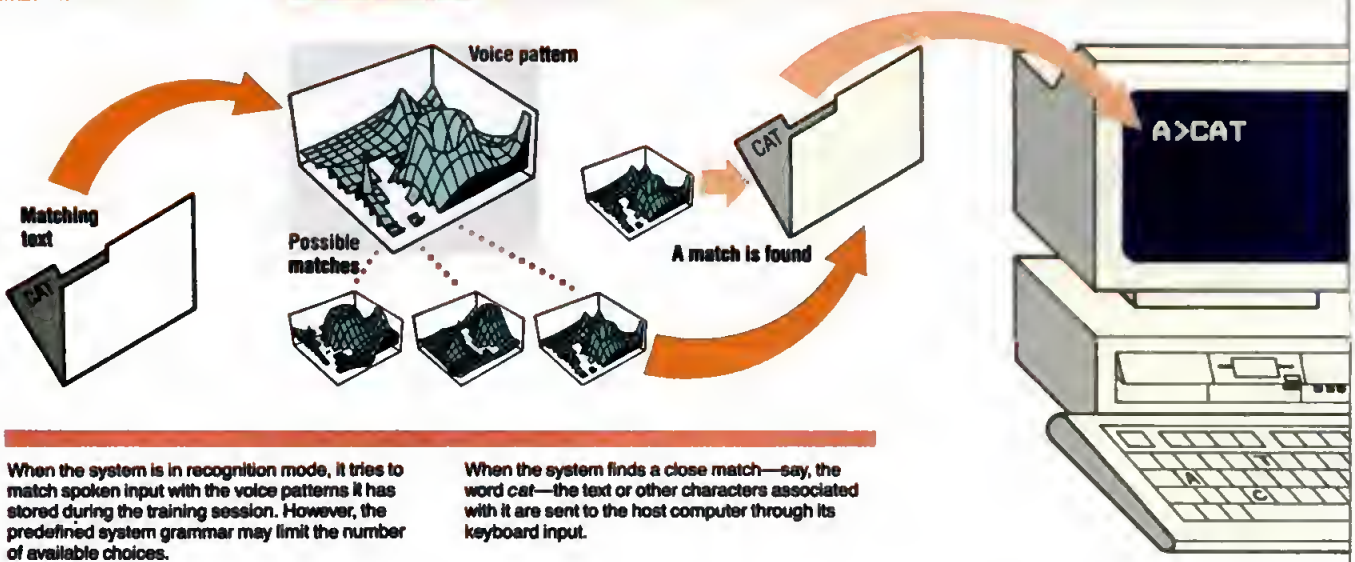
Despite its increasing use, voice recognition remains one of the most misunderstood PC enhancements. For instance, it's often confused with voice digitization. Although digitization is part of most voice-recognition systems, in common parlance the two terms refer to different technologies.

Voice digitization means simply converting analog voice signals into a digital format that computers can manipulate and store. Voice digitization is the operating principle of hardware systems that let your PC act like an expensive (and intelligent) telephone-answering machine, or allow your PC to take dictation and play back your voice as sound (but not as text), exactly as it was heard.

Voice-digitization systems do not try to fathom the meaning of what you say. They copy sound but do not understand it.

Voice-recognition systems, however, listen to your words and try to identify them. Once a voice-recognition system identifies a spoken word or phrase, it reacts. The course of action depends on how you program the system. Generally they will transmit ASCII characters to a computer host or to an application running on the host.

THE MAGIC OF RECOGNITION The magic of voice recognition comes when the system figures out the words you've spoken. Although each system has its own



When the system is in recognition mode, it tries to match spoken input with the voice patterns it has stored during the training session. However, the predefined system grammar may limit the number of available choices.

When the system finds a close match—say, the word *cat*—the text or other characters associated with it are sent to the host computer through its keyboard input.

modus operandi, the currently available voice-recognition systems use several common approaches.

Most systems begin by taking an electrical analog voice signal, gleaned from either a microphone or telephone, then running it through filtering and digitization circuitry. Commonly, these systems sample the sound signals about once every 10 milliseconds, divide the signal into up to 30 frequency bands, and measure the vocal power contained in each band. They record the numbers derived from these measurements as a set. A collection of these sets forms a voice pattern, which is called a voiceprint or voice template.

Recorded voice patterns are later compared with those newly spoken. When a match that is within predefined limits of acceptance is found, the speech is recognized.

All PC-based voice-recognition systems must be trained to understand your voice. First you have to wire yourself to the voice-recognition machine so that it can hear you. The systems generally either provide a headband that you saddle to your skull—and upon which you hang a boom microphone that dangles in front of your mouth—or make you talk into a Las Vegas–style hand-held mike. You must maintain a consistent speaking distance from either microphone—no wandering freely and conversing with the computer, although you can use a wireless microphone to make your headset-cum-collar mobile.

In general, training consists of speaking into the mike the vocabulary of words that you want the system to recognize. During training, the voice-recognition system stores voice patterns for each word in the vocabulary. Because people never pronounce the same words in exactly the same way, most voice-recognition systems combine three to five utterances of the same word to create an average pattern, or maintain several patterns of each word so that common vocal variations will find their matches. You might also need to retrain the system every few months as your voice unavoidably changes.

While voice-recognition hardware is becoming more forgiving in what it accepts and understands, you'll still have to talk as consistently as possible. With inexpensive systems, that means speaking in a dull, expressionless monotone—unless you can keep up the same fevered excitement day after day.

Different systems use different methods for analyzing voice input. Some voice-recognition systems analyze their input in the time rather than frequency domain: they may scrutinize the signals differently, and they may use different algorithms in pattern matching. Some even extend their analysis over several words and use artificial intelligence techniques to constantly update their perception of your voice and vocabularies.

MATCHMAKING The big difference between various voice-recognition systems is not in how accurately they can

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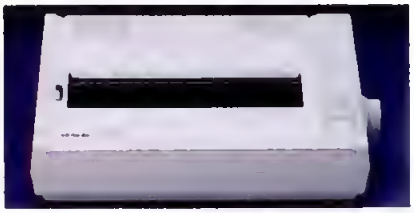

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CIRCLE 183 ON READER SERVICE CARD

identify words—most average well above 90 percent—but in the context they use to pick out the sounds to make their matches.

Systems are customarily classified as either speaker dependent or speaker independent. A speaker-dependent system is trained to recognize the voice of one particular individual. He speaks and the system records his voice patterns, then later tries to find the best match to those patterns.

The speaker-independent system reacts no matter who speaks. In its purest form, the speaker-independent system would need no training whatsoever. It would be able to identify words from the spoken phoneme content no matter who said them. However, no commercial system has reached this ideal for more than a rudimentary vocabulary—specifically, digits 0 through 9.

Some systems, for instance the ITT Voice Communications System from Xtra Business Systems and the TI-Speech System offered by Texas Instruments, have found a middle ground and might be called "almost" speaker independent. The TI-Speech System is independently trained with up to eight different voices uttering the same vocabulary. Eight different files of voice patterns result, which a special TI program can combine into one master pattern. You can then install the same master pattern in several voice-recognition systems to enable each one to identify the commands spoken by any of the eight trainers. The ITT Voice Communications System works similarly.

Votan offers another variation on speaker independence. You can install up to three of the company's VoiceCards in a single computer and train each one to recognize a different voice.

Nearly all voice-recognition systems allow you to train several times with different voices to create several voice-pattern files. You can then load a selected file so that the system will recognize a particular user, but only one voice at a time.

WORD VS. SPEECH RECOGNITION

While some voice-recognition systems identify only isolated words (also called discrete utterances), others recognize continuous (also called connected) speech.

The earliest voice-recognition systems were limited to recognizing isolated words or phrases. That is, anything the system was to understand had to be temporarily isolated from other sounds. These systems depended on silence—sometimes up to a second and a half—before and after a spoken command to identify when the command began and ended.

But real people do not normally speak in disjointed phrases. They generally slur everything into one long, flowing confusion. Connected-speech recognition systems constantly monitor the conversation or monologue and react when they can match a voice pattern within it.

■ Voice-recognition systems can be either standalone peripherals or expansion cards that slide into PCs. The former have a powerful advantage.

Context sensitivity, also known as "subgroup windows," "class parameters," "voice menus," and "grammar branches," is another feature that separates voice-recognition systems. The first systems that worked with PCs were generally limited to small vocabularies since the simple audio analyses they performed could not sort through ambiguous words. But now, most voice-recognition systems include some form of context sensitivity.

These modern systems are sensitive to specific words or phrases only when they are heard in a specific context; they will understand a given command only when it follows another prespecified command.

In effect, these systems work like menus with submenus. As you travel down a series of submenus, only certain commands are valid, and other commands may change in meaning as their location in the grammar system changes. Using these submenus, the voice-recognition system can sort through fewer patterns to find a match than it would were it searching one large vocabulary. Context sensitivity helps the current crop of products achieve higher accuracy and greater speed.

Some modern systems refine context sensitivity to the point that they examine all commands in context. They can resolve ambiguities by determining whether a series of commands is an allowable sequence based on user-defined rules for command patterns. These rules are called a grammar.

Voice-recognition systems can be either standalone peripherals or expansion cards that slide into PCs. The former have a powerful advantage: for the most part, they are free-standing computers optimized for speech analysis. These external systems usually recognize words faster because they have their own built-in microprocessors that don't have to share time with applications running on the host computer. However, because external systems are linked to their hosts by serial cables, communications (such as downloading voice patterns) can be slow, and transferring some keystroke sequences can be difficult or impossible.

Simple internal voice recognizers rely on the microprocessor in their host to match patterns. Consequently they operate more slowly for a given vocabulary size. On the other hand, they are also less expensive and, because they are linked directly with the expansion bus of the host computer, are better able to communicate odd key combinations.

Some internal voice recognizers have their own on-board microprocessors. They combine the speed and power of the external systems with the conveniences and some of the cost advantages of the simple internal systems.

Note that in any case voice recognition is never instantaneous. Making pattern matches for large vocabularies can take a quarter to half a second even with the most powerful external systems. Slower internal systems may take one or more seconds to make a match. Although this recognition rate can be burdensome when sending individual characters to the host, when one voice command acts as the equivalent of multiple keystrokes or even multiple words, speech input can still be substantially faster than typing.

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CIRCLE 210 ON READER SERVICE CARD

Choosing a voice-recognition system requires comparing features and capabilities rather than raw accuracy. The reviews that follow, arranged in alphabetical order by vendor, highlight the features and functional differences between many of the voice-recognition systems currently available for PCs. None of them is perfect, but one of them will undoubtedly suit your voice-recognition needs.

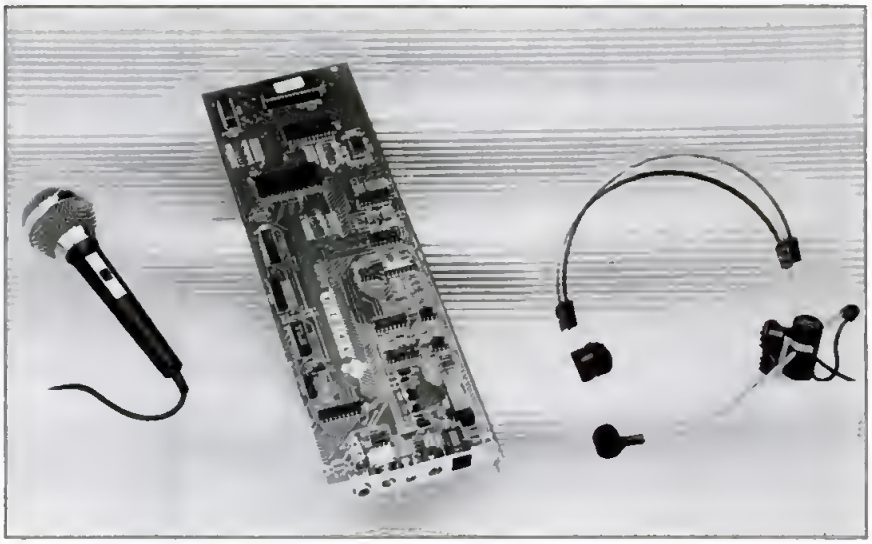
DRAGON SYSTEMS INC.

VoiceScribe-1000

Dragon Systems' VoiceScribe-1000 is a complete and versatile isolated-word voice-recognition system. While it supports context sensitivity, the $1,195 system also has a 1,000-word vocabulary (if you have enough RAM), which makes it large enough to take dictation to a limited extent, automatically transcribing your spoken words into text.

Software gives the VoiceScribe-1000 its power. And the most important part of that software is VOCL, Dragon Systems' macro-language compiler that allows you to construct a voice-recognition grammar for the system.

The grammar is a set of rules that describes the commands that various recognized words represent and how those commands operate together. The grammatical rules allow you to dynamically narrow or change the active vocabulary depending on the location of a command in the grammar system.



The VoiceScribe-1000 hardware consists of an expansion board that uses on XT-style 8-bit data bus. You can choose a Realistic hand-held dynamic microphone or o Shure SM10A headset.

For instance, you can limit the system's initial vocabulary selection to five or ten words, each of which could then open a new vocabulary of its own, which can also overlap the others. Since the VoiceScribe-1000 needs to check only a handful of words at each step, it can react extremely quickly.

The VOCL macro language is quite complete. It allows for random-length voice input and can detect when your voice input doesn't fit a particular context. For example, if you program a command that requires a telephone number as its response, the system can verify if particular numeric values are within the proper limits—in this case, seven to ten digits. The VoiceScribe-1000 will recognize only those spoken phrases that are legal under its current grammar system, improving overall system accuracy.

As you build the grammar, you list the vocabulary it uses along with the keystrokes that each command will simulate. You can attach 127 keystrokes to each command.

In its latest form, the VoiceScribe-1000 handles EMS (expanded memory). If you have enough RAM, you can use the system's full 1,000-word vocabulary.

Once you've worked out a grammar, you write it as a series of VOCL commands into a disk file using any word processor that generates standard ASCII files. The VOCL compiler itself transforms the text file into binary code that the VoiceScribe-1000 system can process.

To link the VoiceScribe-1000 to your software, Dragon Systems supplies a memory-resident keyboard driver called DragonKEY that allows you to use voice commands and your keyboard simultaneously.

If you don't want to construct grammar from scratch, Dragon Systems includes several prefabricated libraries with the VoiceScribe-1000. You can add new words to the predefined vocabulary by using the menu-driven DragonKEY system. You can enter command keystrokes manually or use a special memorization mode that reads your keystrokes as you type them at the keyboard.

The DragonKEY system includes pop-up menus that display the currently available commands even from within other applications. In addition, all training, testing, and vocabulary functions are constantly available through these menus.

A CLEVER SCRIBE The VoiceScribe-1000 has a remarkable aptitude for taking dictation. For instance, the software knows enough to capitalize at the beginning of a sentence. If you're careful when you build the grammar, you can even

FACT FILE

VoiceScribe-1000
Dragon Systems Inc.
90 Bridge St.
Newton, MA 02158
(617) 965-5200
List Price: $1,195
Requires: 200K RAM, additional 400K bytes per vocabulary word, hard disk, DOS 1.0 or later.
In Short: An internal context-sensitive isolated-word voice-recognition system with a large enough vocabulary (1,000 words) to allow taking dictation, plus an extensive grammar for accuracy.

CIRCLE 653 ON READER SERVICE CARD

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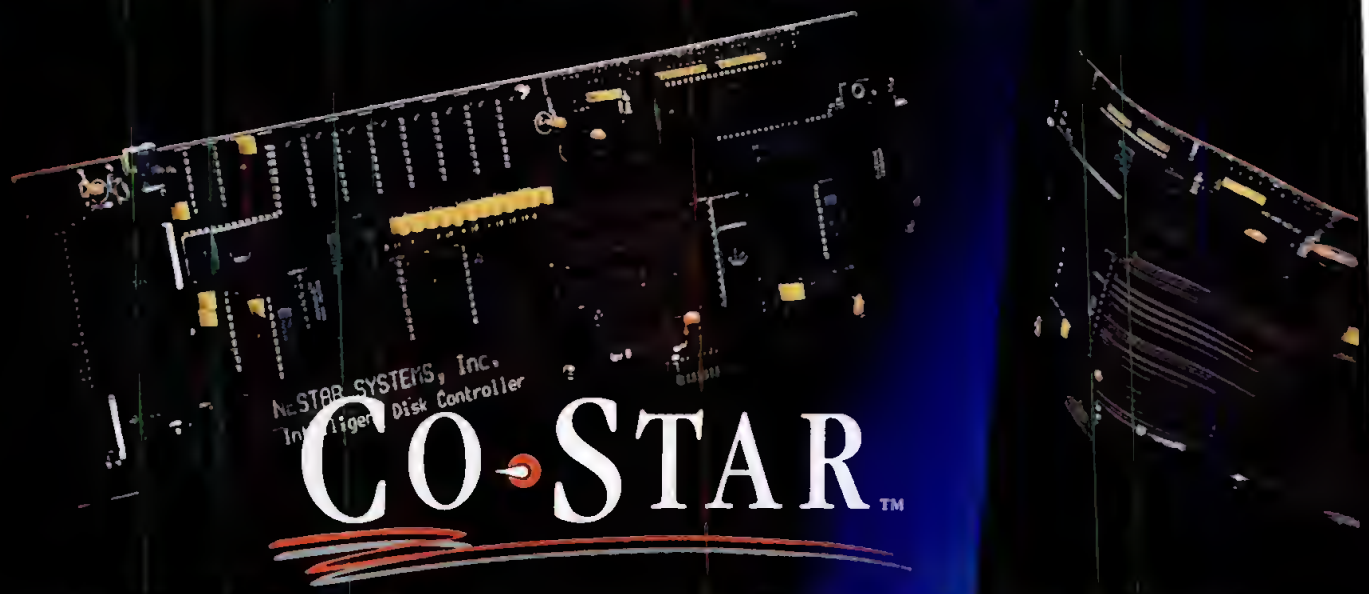

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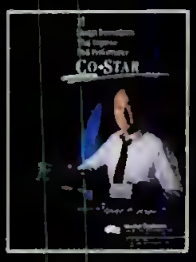

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CIRCLE 220 ON READER SERVICE CARD

switch between the command and text modes of your word processor and edit what you dictate under voice control.

Remember, though, that the VoiceScribe-1000 is an isolated-word system and makes no pretense of understanding connected speech. You must surround each word or phrase that you speak by a substantial pause, and inflect your speech consistently.

Because the VoiceScribe-1000 is speaker dependent, it must be trained. The Dragon Systems training procedure is entirely prompted. In general you must repeat a word five times in succession, and the system immediately derives a recognition pattern from it or informs you that you must try retraining the word.

You can retrain individual words in the vocabulary, and you can vary the number of repetitions for the training of a word from four to nine. Dragon Systems also includes provisions for testing the accuracy of the voice-recognition abilities of the VoiceScribe-1000 before you put it to work.

Additionally, the VoiceScribe-1000 incorporates a mode called adaptive training that facilitates adjusting the system to the inevitable changes in a voice that occur with the passing of months or years.

The VoiceScribe-1000 hardware consists of a full-length, XT-height expansion board that uses an XT-style 8-bit data bus. The board, prominently marked with the logo of Cherry Electrical Products, a keyboard and switch manufacturer, is sparsely populated, and its principal components bear only proprietary markings.

The retaining bracket of this card is replete with a volume control and several connectors: an RJ-11 jack for attaching telephones, a quarter-inch phone jack for a microphone, a subminiature phone jack for an on/off switch, and an RCA-style pin jack.

Dragon Systems supplied two microphones with the VoiceScribe-1000 evaluation system: a cheap, hand-held Realistic dynamic microphone and a headband-style Shure SM10A for hands-free use.

Perhaps one of the biggest assets of the VoiceScribe-1000 system is its documentation. Contained within a thick, loose-leaf binder, it is thorough and provides an unusual amount of background. It's one of the best introductions to voice-recognition technology available.

The VoiceScribe-1000 system bridges the wide gap between usefulness and exploratory potentials. You can make a very workable and functional everyday voice-recognition system from it, use it as a testbed for developing speech technology, or just experiment.

IBM CORP.

IBM Voice Communications Option

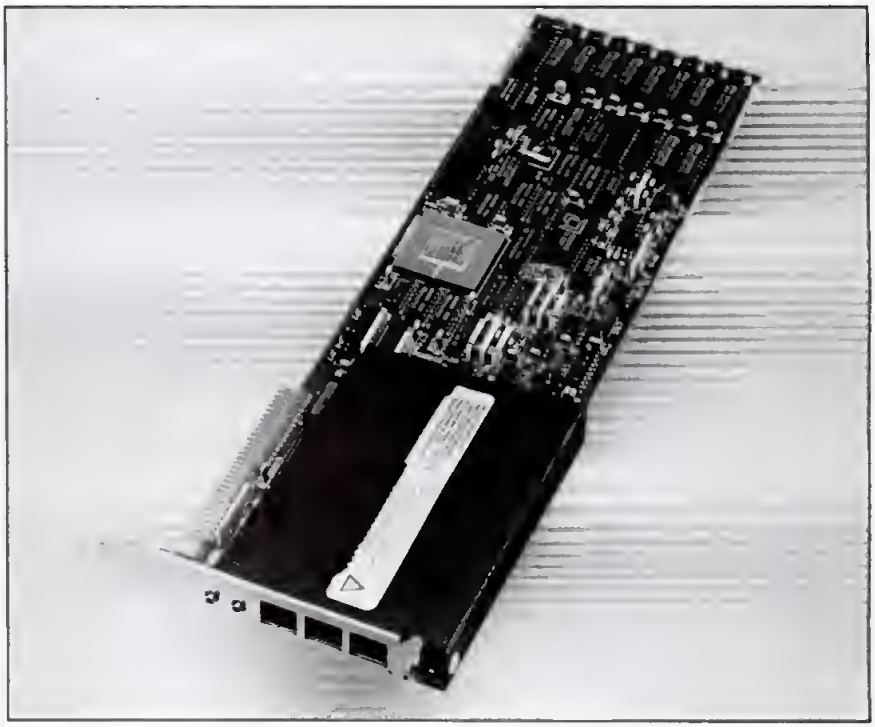
IBM uses its $950 IBM Voice Communications Option, which is simply a specialized PC expansion board, as a foundation for several applications. One of these, the IBM Voice-Activated Keyboard Utility, allows users to activate keystrokes by voice. The same hardware also serves as the basis for the IBM Voice/Phone Assistant telephone management system and the IBM Augmented Phone Services, an aid for the speech- or hearing-impaired.

The IBM Voice-Activated Keyboard Utility strongly resembles Dragon Systems' VoiceScribe-1000. The two systems share the same interface and control software, including Dragon Systems' VOCL macro language for constructing a voice-recognition grammar. Understandably, many of the characteristics of the two systems are the same.

For instance, using VOCL, you can control the context sensitivity of the Voice-Activated Keyboard Utility, subdividing the total system vocabulary into groups of a dozen or so active words and linking commands to a voice-menu structure. As an isolated-word recognition system, the Voice-Activated Keyboard Utility requires you to surround each word (or phrase) by a pause of about one-half second in order to be recognized.

Unlike Dragon's VoiceScribe-1000, however, IBM's Voice-Activated Keyboard Utility lacks EMS support and is limited to a smaller vocabulary—160 words or phrases—per voice-pattern overlay file. Each command in an overlay can represent the equivalent of 127 keystrokes.

The Voice-Activated Keyboard Utility is speaker dependent and consequently



The IBM Voice Communications Option is an XT-height PC expansion board that serves as the foundation for voice-activated macros and a telephone management system.

FACT FILE

IBM Voice Communications Option
IBM Corp.
Old Orchard Rd.
Armonk, NY 10504
(800) 447-4700
List Price: $950
Requires: 22K RAM to 256K RAM depending on the applications program, two disk drives, DOS 2.1 to 3.1.
In Short: An extremely versatile isolated-word voice-recognition board with text-to-speech abilities. It can function, for instance, as a voice-activated keyboard or a communications system for the handicapped with IBM software.

CIRCLE 652 ON READER SERVICE CARD

must be trained. The IBM training procedure, designed to ease you into voice-recognition technology, is entirely prompted. Just as for the Dragon Systems procedure, you must repeat a word five times in succession, at which point the system either derives a recognition pattern from it or tells you to retrain the word. You can retrain individual words in the vocabulary and vary the number of word-training repetitions from four to nine.

If you follow the IBM training scheme, you'll first be instructed to use a prefabricated overlay file to gain familiarity with a memory-resident pop-up program, which is loaded by the batch file KEYINIT. This program allows you to add, train, retrain, and test the Voice-Activated Keyboard Utility commands at any time, even while you're working in almost any other application.

This ready-to-use vocabulary—and the several other overlays included with the Voice-Activated Keyboard Utility software—may be as far as most people will want to delve into the intricacies of voice recognition. But the abilities of the IBM system don't stop there.

DEVELOPING APPLICATIONS As you go through the instruction manual, you'll gradually develop techniques for using the full VOCL language to develop your own vocabularies and grammars and adapting the Voice-Activated Keyboard Utility to work with your applications.

Once you work out the grammar you want, you write it out using the VOCL commands and a word processor that generates standard ASCII files. The VOCL compiler itself transforms the text file into binary code that the IBM Voice Communications Option can process.

The Voice Communications Option consists of a full-length, XT-height expansion board that uses an XT-style 8-bit data bus. The board, which is entirely different from that used by the Dragon Systems' VoiceScribe-1000, is loaded with circuitry, including a Texas Instruments TMS32010 speech processor and a hefty IBM proprietary VLSI chip. The retaining bracket of this card is replete with a number of telephone-style connectors for which IBM supplies adapter cables that you use to hook up the system.

The Voice Communications Option also supports telephone dialing, text-to-speech synthesis, and DTMF (Dual Tone, Multiple Frequency, or Touch-tone) detection. These features enable it to function as a telephone management system (automatic dialer) and as an aid to the hearing- and speech-impaired.

In the latter application, the board can generate spoken words from text entered at the keyboard to give the speech-impaired a telephone voice. DTMF recognition is used to let people at the far end of a telephone connection spell out words using an ordinary Touch-tone–style telephone. Undoubtedly, this software is only beginning to tap the potential of the Voice Communications Option.

INTERPATH CORP.

VoiceCommand

Interpath Corp.'s $199 VoiceCommand looks modest—the package consists of just a slim plastic binder and a short card. But context sensitivity makes VoiceCommand speedy and accurate, since it enables the system to work with just a small subset of its 200-word, user-defined vocabulary at any one time.

VoiceCommand's context sensitivity is implemented as a set of user-defined nested menus. A single voice command not only sends instructions directly to its host computer through the PC bus and keyboard interrupt, but can also call up another recognition vocabulary. Each individual vocabulary is maintained in a separate command menu, much like those used by keystroke-activated programs.

FACT FILE

VoiceCommand
Interpath Corp.
4423 Cheeney St.
Santa Clara, CA 95054
(408) 988-3832
List Price: $199
Requires: 64K RAM, one disk drive, DOS 1.0 or later.
In Short: A simple but workable context-sensitive, isolated-word, speaker-dependent internal voice-recognition system that can be adapted to a variety of applications.

CIRCLE 651 ON READER SERVICE CARD

In effect, VoiceCommand uses the audio equivalent of *1-2-3*'s nested menu structure, which makes the system a natural add-on for programs with a Lotus-like command framework—although the system is not limited to such applications.

Because every word in the VoiceCommand vocabulary has macro capabilities, a single spoken word can invoke a lengthy train of commands. For instance, you could say "Heading," and VoiceCommand would knock out an entire return address for a letter being written in *Microsoft Word*.

The VoiceCommand software can be divided into three effective parts: constructing menus, training and loading menus, and entering voice patterns into memory.

The part that builds menus automatically links them together and assigns command strings to function names.

Menus are constructed in semi-free-form format. You type the identifying name, the keyboard input to be simulated, and menu linkages on the screen. You can make changes randomly, using the cursor keys to move around.

Although Interpath recommends that you assign no more than ten commands per menu, the number you can actually specify is constrained only by the memory limitations of the host system. You can also assign function keys to duplicate the voice implementation of the first ten commands

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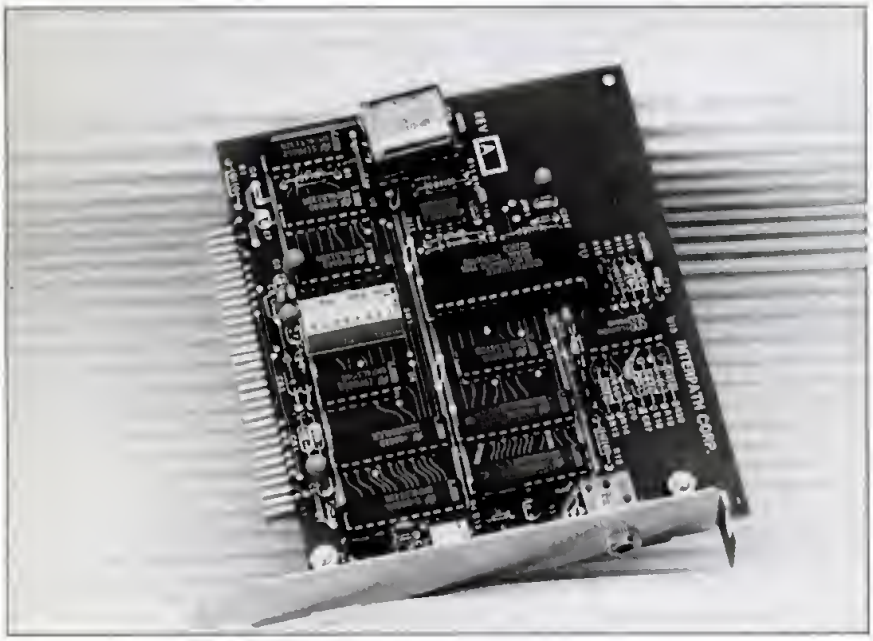
CIRCLE 386 ON READER SERVICE CARD



The Interpath VoiceCommand hardware consists of a 5-inch XT-height expansion board that plugs into an 8- or 16-bit slot. A miniature phone jack accepts a user-supplied microphone.

on each menu. A separate program trains VoiceCommand to recognize your voice and execute each command string.

VoiceCommand accommodates multiple users. Each user must train the system separately and save his or her voice patterns in a different file. When you start running VoiceCommand you merely load the voice patterns for the person to be recognized.

VoiceCommand oversees its own training sessions and prompts you to speak for each command. Interpath recommends training each command four times or more. Voice patterns are automatically stored on disk.

But VoiceCommand can be unforgiving. Although you can retrain individual commands, altering a single menu entry requires you to retrain every command in the system.

To load a specified set of menus and voice patterns into memory, you use a third program. You then activate the menuing system by pressing both Shift keys simultaneously. You can switch the microphone on and off by pressing the NumLock key; this prevents the inadvertent recognition of speech during conversations.

■ Interpath's Voice Command oversees its own training sessions and prompts you to speak for each command.

The VoiceCommand hardware consists of a single 5-inch XT-height expansion board that plugs into any 8- or 16-bit expansion slot. One connector, a miniature phone jack, accepts a user-supplied microphone. No hardware adjustments are normally required—the one DIP switch bank on the board is factory adjusted to the only setting supported by the VoiceCommand system. The whole card is little more than an Interstate Electronics voice- recognition chip and bus interface hardware.

Although VoiceCommand is primitive by today's standards, its context-sensitive menu structure makes it a reliable add-on for modest-scale applications.

INTERSTATE VOICE PRODUCTS

VocaLink CSRB
VocaLink SRB-LC

These two representatives of the Interstate Voice Products line have less in common than their similar initials would seem to indicate. The Speech Recognition Board (or SRB) is a context-sensitive, isolated-word internal voice recognizer that installs in the short XT or PC expansion slot and uses the microprocessor resources available there. The $395 VocaLink SRB-LC, which we review here, extends these capabilities to the AT.

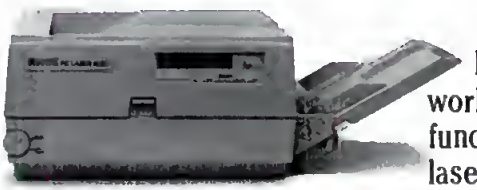
The full-length VocaLink Connected Speech Recognition Board (or CSRB) is more like an external voice recognizer that has gone internal. Priced at $1,250, it's completely equipped with its own powerful microprocessor (an Intel 80186) and memory. Although it slides inside a PC, XT, or AT, it externally taps into the keyboard connector to take control.

Though the more modest of the two products, the SRB is a completely workable voice-recognition system. Combined with the software supplied, it can recognize up to 400 commands using a context-sensitive structure that can comprise up to 200 menus. However, because it steals thinking time from the host computer, it can slow down processing; it also drains away about 64K of memory when operating in the background. Consequently, Interstate recommends that your host computer have at least 256K of RAM so that applications can run along with the SRB system.

You'll need to use several programs to set up and run the SRB. One, VOCALKEY, is a memory-resident keyboard driver that enables the SRB to send keystroke commands directly to applications through the PC bus. This program also includes pop-up menus that list the available commands—up to 20 on the screen at a time—and it allows you to define commands, train, retrain, and test from within applications.

VOCALEDT helps you set up and edit vocabulary files and allows you to configure the menu structure—that is, determine which commands open new menus and provide access to further commands. You can substitute a text editor when setups be-

See the first laser printer in history to fly two people to Tokyo.



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CIRCLE 395 ON READER SERVICE CARD

Folded edge of the page

Foldout slip-sheet

1. Open the foldout page
2. Insert this sheet with
   1. Front side touching the free page
   2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet

GbsSlipSheet-001

Inverted Foldout slip-sheet

1. Open the foldout page
2. Insert this sheet with
   1. Front side touching the free page
   2. Arrow pointing to the fold
3. Slice the folded edge
4. Close the page and slip-sheet

1. Follow instructions on the other side

Inverted Back

GbsSlipBack-0018

Back

1. Follow instructions on the other side

NEY-BACK G

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Oh!! One more thing —

EVERYBODY WINS a $10 Logicsoft discount coupon, good towards your next Logicsoft purchase. So now not only have you entered this stupendous sweepstakes, but you're getting an additional $10 off Logicsoft's already low prices on their entire inventory; and you still get their 30 day money-back guarantee!! Whatta deal!!
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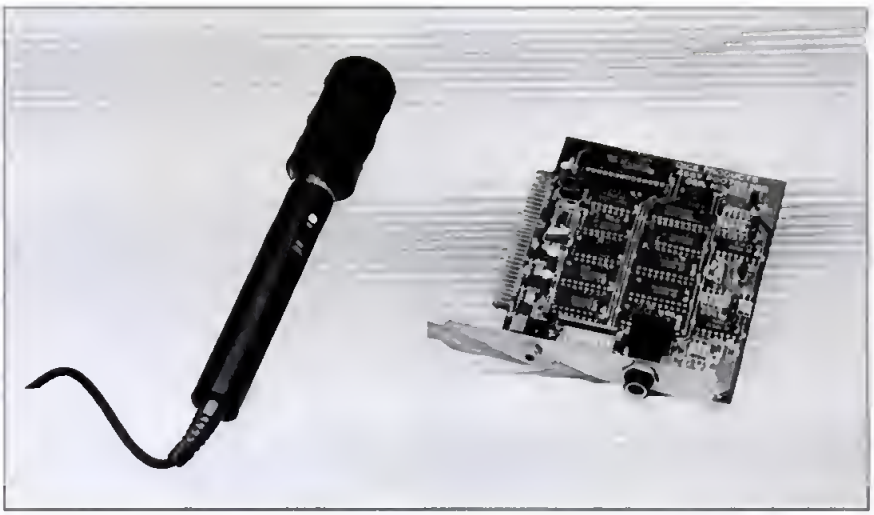
PC MAGAZINE FACT FILE

VocaLink CSRB
Interstate Voice Products
1849 W. Sequoia Ave.
Orange, CA 92668
(714) 937-9010
List Price: $1,250; microphone, $160.
Requires: DOS 1.0 or later.
In Short: One of the few context-sensitive systems that attempts to recognize connected speech. An internal board, it uses an 80186 microprocessor to increase recognition speed.
CIRCLE 650 ON READER SERVICE CARD

VocaLink SRB-LC
Interstate Voice Products
1849 W. Sequoia Ave.
Orange, CA 92668
(714) 937-9010
List Price: $395
Requires: 64K RAM, one disk drive, DOS 2.0 or later.
In Short: A simple but context-sensitive isolated-word internal voice-recognition system with a vocabulary of 400 words.
CIRCLE 649 ON READER SERVICE CARD

The VocaLink CSRB comes complete with its own Intel 80186 microprocessor and memory. Though it is a full-length card that fits inside a PC, it taps into the keyboard connector externally.



The VocaLink SRB-LC installs in the short XT or PC expansion slot, where it steals 64K of memory when operating in the background. Unlike the CSRB, it recognizes isolated-word speech only.

come more complex than VOCALEDT can handle.

Another program, VOCALGEN, takes the vocabulary created by VOCALEDT or another editor and generates a binary file that the SRB board can understand and use in training. Commands sent to the keyboard can contain ASCII text and control characters as well as most PC function and Ctrl keys except, inexplicably, Alt or Shift. In addition, VOCALGEN also features a special wait-for-keyboard input command.

VOCALINK handles training. Normally, it requires a minimum of three passes. It allows prompted training of an entire vocabulary or individual training of a single word. It also lets you test the recognition accuracy of each word.

POWERFUL SPEECH BOARD According to Interstate, systems that recognize connected speech require 6 to 10 times more microprocessor power than do systems that recognize isolated words. Ask a PC to plow through connected-speech recognition, and it probably won't be good for anything else. Therefore, to add connected-speech abilities to the SRB system, the company created the CSRB board with heavy-duty horsepower: a full 16-bit microprocessor.

Even with its 80186 chip, the vocabulary of the CSRB is more modest than that of its smaller sibling—only 240 words or phrases in a maximum of 50 syntax nodes (context-sensitive menus), and only 20 nodes are available when you use the system's built-in vocabulary editor.

Unlike the SRB system, the CSRB uses one integrated program, VOICE, to set up and control its operation. You can also substitute QVOICE, an easier-to-use program that lacks many of VOICE's advanced features.

Your first step in using CSRB is creating a vocabulary and determining the interrelationships between the various commands (system grammar). Interstate asks that you begin by diagramming your complete system out on paper, then enter the

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SELECTING VOICE-RECOGNITION SYSTEMS

With today's voice-recognition systems, a tremendous price spread reflects a myriad of differences in features.

The primary difference between various voice-recognition systems is not accuracy. Actual performance varies more between users than between different voice recognizers. As you learn to use a given system over a number of months (as it trains *you*, so to speak), recognition accuracy will gradually improve, and most people can expect to achieve a recognition rate of 98 percent or better.

The amazing price spread among these devices reflects a multitude of underlying differences, however. At the low end, you'll find $200 plug-in boards accompanied by software with a limited number of features. At the high end are external voice recognizers that are designed for work as terminals in industrial applications; these units are usually sold as complete systems, with extensive on-site training also offered. Such systems can cost nearly $9,000.

Selecting a voice-recognition product demands that you match a system to your needs rather than looking at some elusive objective standard. Put simply, any of these devices will allow you to say "Save" to automatically tell *1-2-3* to /FSbudget<Enter>. Few will pick out the numbers of a ZIP code hastily shouted while a package rattles down a noisy sorting line. Since you can't really compare such vastly different systems, we did not make an Editor's Choice for the products reviewed in this article. Rather, we describe the applications to which these products are best suited.

Your first step, therefore, must be to evaluate your application to see what features you need. Specific requirements will best guide your choice to a particular product. The primary consideration is, of course, how you plan to use voice recognition.

If several people are likely to share the voice-recognition system—say, perhaps sharing a voice-actuated database over a network—you'll want to consider the limited degree of speaker independence offered by the TI-Speech System from Texas Instruments and ITT Voice Communications System from Xtra Business Systems.

Should you need the ability to pick a few words out of connected speech—understanding complete, freely spoken sentences is still well beyond the reach of these voice recognizers—you should investigate the equipment from Scott Instruments Corp., Texas Instruments, Verbex Voice Industries Corp., and the Interstate Voice Products CSRB board.

When you need some confirmation or response to your spoken commands, voice digitization or text-to-speech synthesis may be mandatory. For instance, you might want an audible confirmation that you've properly entered a part number into your inventory system. Voice recognizers from Xtra Business Systems, Texas Instruments, Scott Instruments Corp., and Votan offer digitized voice capabilities. Systems from IBM, Xtra Business Systems, and Texas Instruments can synthesize speech from text.

Several systems offer large on-line vocabularies. The leaders in this respect are Dragon Systems and Kurzweil Applied Intelligence, both of which promise a full 1,000 words and the ability to take isolated-word dictation. With them, you could talk to your word processor and have it create and print reports without your touching a key.

For operating typical DOS-based applications such as running a spreadsheet or editing a document by voice command, context sensitivity helps improve the speed and accuracy of recognition. The majority of systems on the market today now deliver this feature (see the features table).

If you're experimenting with voice recognition or your applications are likely to change often, you may want to opt for a system that requires a minimum of training. Votan's VoiceCard Package and Microphonics Technology Corp.'s Pronounce train with just one pass. If you opt out of verification, Roar Technology's VoiceKey learns just as quickly.

Other systems offer their own unique advantages, such as the voice-recognizer-in-a-keyboard from Key Tronic Corp. or the Verbex Voice Industries cartridge system.

With today's voice-recognition systems, the bottom line is simple: the system that will work best for you is the one that does what you need it to do.

—Winn L. Rosch

commands and grammar into the VOICE program.

You then use VOICE to train and check the vocabulary and save the resulting voice patterns on disk. You can use VOICE to enter recognition mode or, alternatively, after you've set up your voice patterns, you can bypass VOICE and begin recognition by loading the voice patterns with a special QLOAD (Quick load) program.

Although the CSRB plugs into the PC bus, it communicates with the host computer by intercepting the keyboard cable, which plugs into the CSRB card itself. Another short cable runs from the CSRB to the keyboard jack on the host computer. The CSRB software allows the system to mimic every legal keystroke and keystroke combination—for instance, Alt-F7.

Although it is implemented somewhat differently in the two systems, both the SRB and CSRB allow user control of intimate voice-recognition functions. You can set not only the microphone gain but also the closeness of the match required for recognition as well as by how much two competing words must differ before the voice

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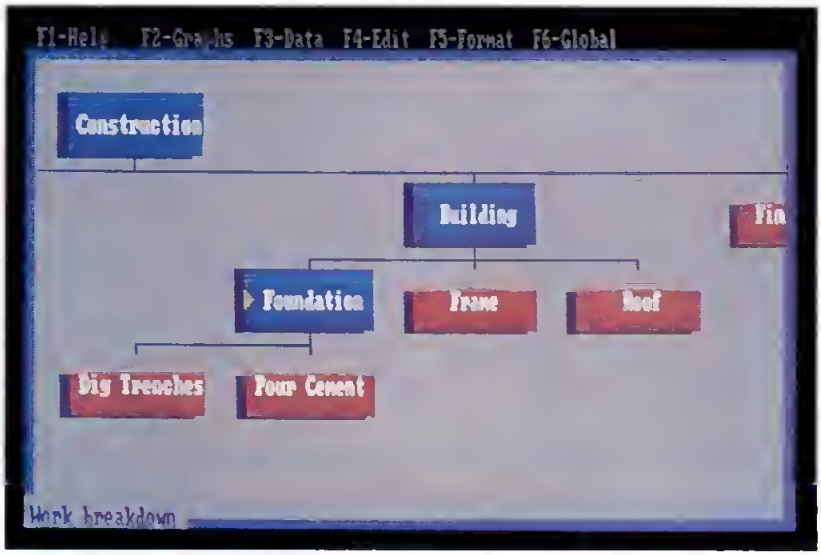

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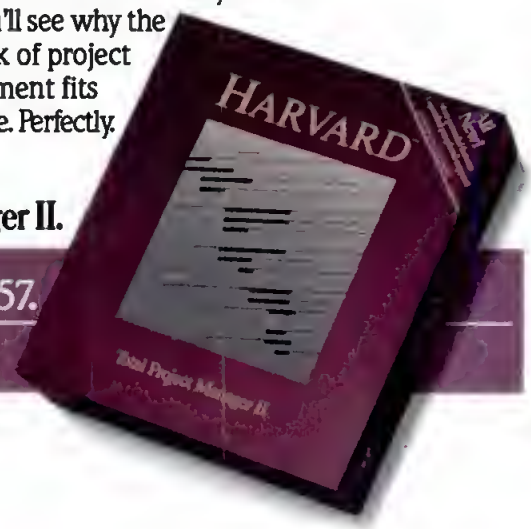

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board decides that the recognition is ambiguous. These and other functions allow you to tune the board for optimal accuracy and reliability.

Interstate allows several choices of microphones, including hand-held and headset/boom varieties. In addition, the CSRB also supports a speech synthesis daughtercard that plays through optional headphones.

All SRB accessories plug directly into the board. The more feature-rich CSRB requires an adapter becuase it has but one connector (a female DB-25) and two LEDs on its retaining bracket. It also has diodes that indicate board status.

The CSRB manual goes into unusual depth. It includes information sufficient to help programmers develop complete voice-recognition systems and offers more background on voice recognition than most people may want to know.

The SRB rates as a medium-performance, yeoman voice recognizer. The CSRB is a higher-performance system suitable for almost any application except those requiring very large vocabularies.

Key Tronic builds its voice-recognition system into its KB 5152V keyboard. You plug the supplied Shure SM10 microphone into the rear panel of the keyboard.

KEY TRONIC CORP.

KB 5152V

Most voice-recognition systems do their best to impersonate keyboards. Key Tronic Corp. goes one step further—it builds its voice-recognition system into one of its keyboards, specifically the $995 model KB 5152V. The product is a moderately advanced, speaker-dependent isolated-word system with context sensitivity.

At first glance, the KB 5152V looks like a hybrid of the various keyboards that IBM has foisted upon unwary PC users. Function keys line the top row, and a dedicated cursor pad (more generous than IBM's) squeezes in between the alphabet keys and the combined cursor/numeric keypad.

The only hint that this is a special keyboard is a new key labeled "Voice" with a built-in LED indicator to monitor its toggling function. This key switches the voice-recognition system of the KB 5152V on and off. An optional footswitch that plugs into the back of the keyboard also performs this function.

Installation is a breeze. On the rear panel of the KB 5152V, you'll find a jack for plugging in the Shure SM10 microphone that's supplied. Slide in the connector, press Voice, and you're ready to go. Like ordinary keyboards, the KB 5152V sucks its power from its host computer through the keyboard cable.

As with most other voice-recognition systems, the first step is setting up a vocabulary. Key Tronic's can comprise up to 160 words, including nine nodes (menu levels).

You can simulate the entire keyboard with these commands. You can indicate normal printable keystrokes and control and function keys to the vocabulary editor just by typing them in. You enter nonprintable keystrokes by hexadecimal scan code (with separate numbers issued to the upstroke and downstroke of each key). You can even set up the Ctrl-Alt-Del combination. If you like hex codes, you can indicate printable keys the same way.

Once you've prepared the vocabulary, you must train the system. The KB 5152V requires at least three learning passes for adequate recognition. You can train and retrain individual words, and the software provides an accuracy check.

Upon completion of the training, the voice data is saved to disk as voiceprints. You must download a voiceprint file into the KB 5152V to start the recognition system. However, the serial keyboard link over which this data must travel operates slowly—about 9,600 bits per second—hence transferring voiceprints to the keyboard can be time-consuming.

FACT FILE

KB 5t52V
Key Tronic Corp.
P.O. Box 14687
Spokane, WA 99214
(509) 928-8000
List Price: $995
Requires: 128K RAM, two disk drives, DOS 2.0 or later; system must support bidirectional communications.
In Short: Voice recognition built into a soft-touch keyboard. Although slow to download vocabularies and lacking some software features, it puts speaker-dependent, isolated-word, context-sensitive voice recognition where it belongs in the data stream.

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The Distinction is Drawn

Once a year, *Software Digest* reviews the industry's best free-form drawing programs and rates them based on power, performance, versatility, and ease of use. This past year, the distinction of "best free-form drawing program" was given to Micrografx Windows DRAW. And with good reason!

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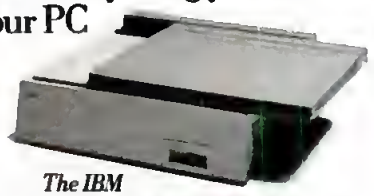

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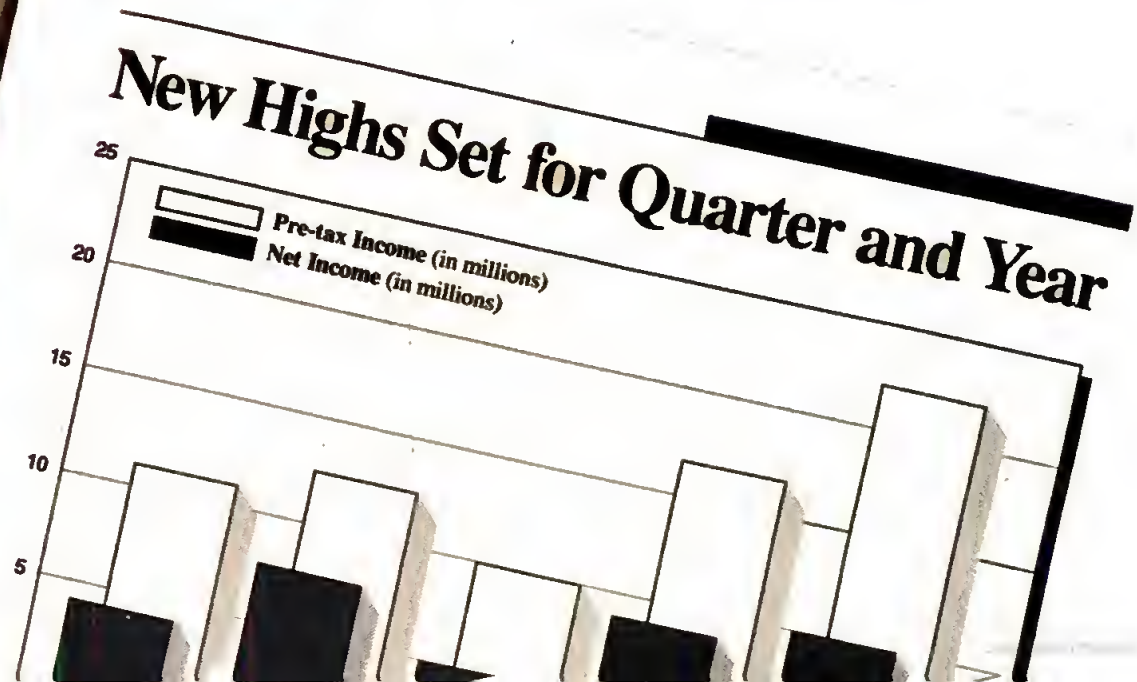
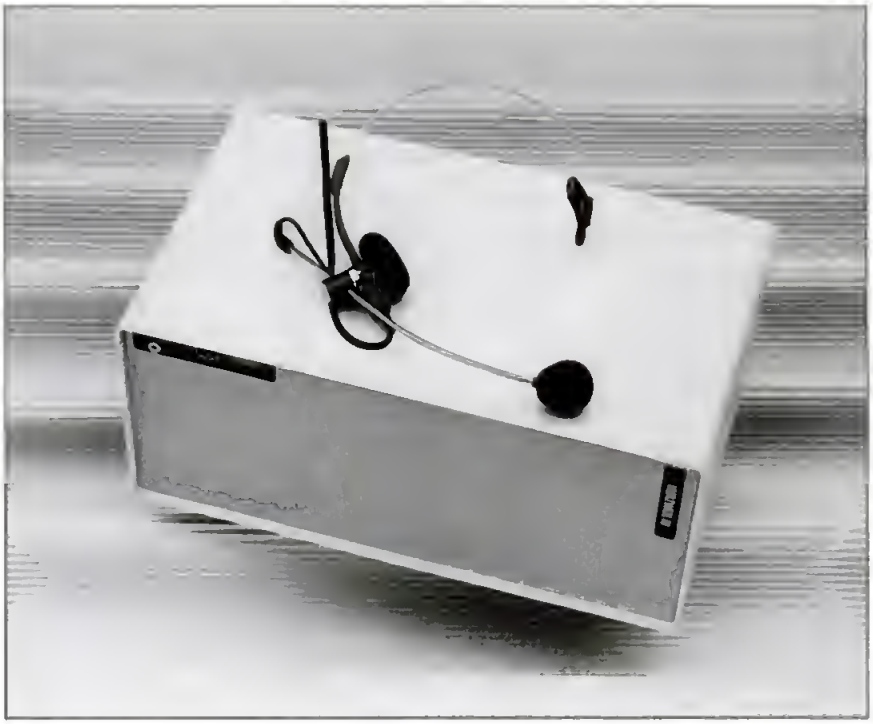


Since the keyboard, which like most other keyboards has its own internal microprocessor, handles the voice recognition, you don't have to execute any software on the host computer to bring the system to life. This design eliminates the possibility of RAM-cram and collisions between background programs. However, it also precludes the use of drop-down or pop-up menus.

Even discounting its voice-recognition abilities, the KB 5152V was meant to be the luxury keyboard that corrected all the "faults" of the original IBM design. Among the hallmarks of the Key Tronic product is its quiet, soft touch (quite unlike the snappy clatter of IBM products) that retains a good subjective feel. Some people like it, some prefer the IBM. Turn on the KB 5152V's voice recognition, however, and you might not even need to bother with what's under your fingers.



The Kurzweil Voicesystem is an external unit that plugs into a PC through a serial interface. It devotes over 1 megabyte to voice-pattern memory and has more RAM for storing commands.

KURZWEIL APPLIED INTELLIGENCE INC.

Kurzweil Voicesystem

Kurzweil Applied Intelligence is commonly regarded as the leader in voice-recognition technology, and the $6,500 Kurzweil Voicesystem proves the point. As Kurzweil's first PC-compatible voice-recognition system and the bottom of the company's product line, the Kurzweil Voicesystem, with its 1,000-word vocabulary, matches the best of its competitors. Newer models in the Kurzweil line that are under development will extend vocabulary capabilities to as much as 20,000 words.

Although the Voicesystem has been successfully used as a dictation scribe in such fields as radiology (an area of specialization that Kurzweil explicitly supports), it is a speaker-dependent, isolated-word recognition system. Its 1,000-word vocabulary can be split into up to 50 context-sensitive subsets. Command sequences sent to its computer host can be any length within the limits of its memory.

The Voicesystem is an external, shoebox-size unit that plugs into PCs, XTs, ATs, and compatibles with a standard serial interface. It adapts itself to and consumes either a COM1 or COM2 port.

Inside the unit is a sophisticated computer, based on an MC68000 microprocessor. This chip was chosen for its memory-handling capacity. The Voicesystem devotes over a megabyte to voice-pattern memory and has an additional bank of RAM for storing commands, according to a Kurzweil representative.

Kurzweil is unusual in the support it gives the Voicesystem. Although the system is available by itself, the company invariably sends it out with one day of on-site training, an option that costs roughly $1,000. The company also offers complete support services, including the development of vocabularies and grammars that perfectly suit a particular application.

The on-site training includes aid in setting up the system. Typical hardware installation is almost trivial: run the included serial cable between the unit and your PC, then plug in the supplied microphone. Switch on the recognizer and host, and you're ready for software installation.

The Voicesystem software includes an automatic installation program that creates a few directories, copies three diskettes of files onto your hard disk, and adds a new entry to your CONFIG.SYS file so that a 20-Kbyte memory-resident kernel program loads when you switch on your PC.

ACCENT TRAINING The next step is enrollment. You speak a list of more than 200 unusual words (including "dragon beast," "oof," and "zombie") three times through. The strange words include samples of every phoneme in the English

FACT FILE

Kurzweil Voicesystem
Kurzweil Applied Intelligence Inc.
411 Waverley Oaks Rd.
Waltham, MA 02154
(617) 893-5151
List Price: $6,500
Requires: 640K RAM, hard disk, DOS 3.3.
In Short: A high-performance, isolated-word, context-sensitive, speaker-dependent external voice recognizer with a 1,000-word vocabulary and enough artificial intelligence to allow taking dictation. Sold with on-site training.

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language. After you utter your last, the Kurzweil software analyzes your speech and builds a file that represents your "accent." Although this process is time-consuming, taking about 40 minutes on an AT, you need perform it only once for as long as you use the Voicesystem.

Finally, you train the actual words that you want the Voicesystem to recognize, again three times through. The trainer will guide you to aim for variation rather than consistency in your pronunciations because this aids the Voicesystem in recognizing different vocal inflections of your commands.

A common interface unites all of the Voicesystem software. This interface is a three-line pop-up window that you can position anywhere on the screen, most commonly at the bottom edge. Programs for daily use, training, setup, maintenance, and diagnostics are also included.

After you enter the Voicesystem menu by DOS keystrokes or by voice command, the system presents you with a new prompt within the window. In response you can type one of an array of commands. The system comes with a quick-reference list so you can negotiate through this command-driven interface. Once started, most of the individual programs are, however, prompted and/or menu driven.

The software allows you to add to your vocabulary, train and retrain commands and their responses, monitor how well the system recognizes your voice and distinguishes commands, and even change system defaults (such as how often your voice is sampled).

As with any system, response time varies with the size of the active vocabulary. According to Kurzweil, even with 1,000 words active, response time will still be under one-quarter second. The only time-consuming part of using the system is loading voice files and recognition information from the host PC into the Voicesystem. Because of the serial interface and the amount of data being moved, this can require several minutes (even though Kurzweil increases serial port operation to 56 kilobits per second).

Kurzweil offers either an Astatic boom/headband microphone or, for executives who don't want to be mistaken for switchboard operators, a telephone-style handset. The earphone of either is active and echoes your voice. Provisions have been made in the Voicesystem for adding a third-party text-to-speech synthesizer.

The added value of individual training makes the Voicesystem the number-one choice for people more interested in taking advantage of voice recognition than in learning the intricacies of yet another new technology. Kurweil's extensive support will help put workable voice recognition into the hands of even the least technically oriented users.

MICROPHONICS TECHNOLOGY CORP.

Pronounce

Although Microphonics Technology Corp. claims that this is the first voice recognition system good enough to identify speech after only one training pass—a capability that is now claimed by several other systems—learning speed is just one of the many virtues of Pronounce. This $695 system comes closer than do most systems to being a keyboard macro program with audio input.

Pronounce incorporates many of the features expected in macro programs, as well as the polished interface of well-honed software. Voice recognition is supposed to be a convenience, and that's what Pronounce makes it.

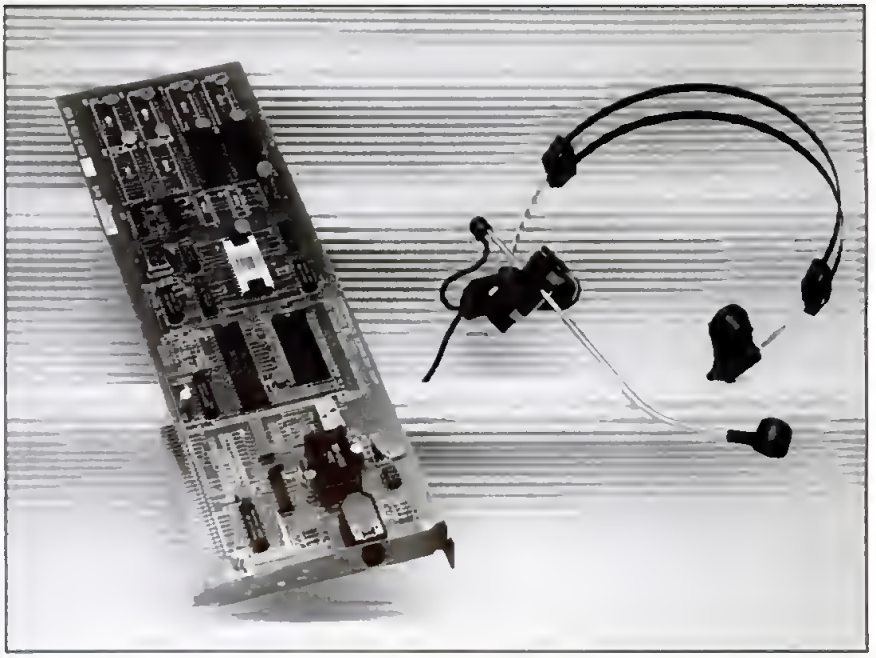
Nearly all of its functions are wrapped in a single program package. Only the modification of a few hardware defaults and options—such as system port addresses—requires the use of a separate installation utility. The package also includes one additional program to simplify the setting of the proper microphone level.

The one program, PN, controls all the

PC MAGAZINE FACT FILE

Pronounce
Microphonics Technology Corp.
13240 Northup Way, #4
Bellevue, WA 98005
(206) 641-7233
List Price: $695
Requires: 72K RAM, one disk drive, DOS 2.0 or later.
In Short: A well-integrated, easy-to-use, speaker-dependent, isolated-word internal voice-recognition system that's quick to set up and trains with as little as one pass.

CIRCLE 646 ON READER SERVICE CARD



Microphonics' Pronounce is a full-length, XT-height expansion board that fits onto an 8- or 16-bit data bus. The Shure SM10A boom-style headset microphone plugs into the card's phone jack.

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TOSHIBA

Toshiba America, Inc., Information Systems Division

Voice-Recognition Systems: Summary of Features

(Products listed in ascending price order)

	List price	Unit placement	Uses own microprocessor	Recognizes isolated words	Recognizes connected speech	Speaker independent	No. of training passes required	Vocabulary size (words)	Context sensitive	Pop-up Menus	Voice digitization	Text-to-speech synthesis
VoiceCommand Interpath Corp.	$ 199	Internal	○	●	○	○	4	200	●	●	○	○
VocaLink SRB-LC Interstate Voice Products	$ 395	Internal	○	●	○	○	3	400	●	●	○	○
IntroVoice VI The Voice Connection	$ 595	Internal	○	●	○	○	3	400	●	●	○	●
Pronounce Microphonics Technology Corp.	$ 695	Internal	○	●	○	○	1	128	○	●	○	○
IBM Voice Communications Option IBM Corp.	$ 950	Internal	●	●	○	○	5	160	●	●	○	●
KB 5152V Key Tronic Corp.	$ 995	External	●	●	○	○	3	160	●	○	○	○
TI-Speech System Texas Instruments	$ 1,150	Internal	●	●	●	Pooling	3	50*	○	○	●	●
VoiceKey Roar Technology	$ 1,195	Internal	○	●	○	○	2	512	○	●	○	○
VoiceScribe-1000 Dragon Systems Inc.	$ 1,195	Internal	○	●	○	○	5	1,000	●	●	○	Optional
VocaLink CSR8 Interstate Voice Products	$ 1,250	Internal	●	●	●	○	3	240	●	●	○	○
ITT Voice Communications System Xtra Business Systems	$ 1,350	Internal	●	●	○	Pooling	4	200 commands per file†	●	●	●	●
VoiceCard Package VPC2150 Votan	$2,700	Internal	●	●	○	○	1	64‡	●	●	●	○
Kurzweil Voicesystem Kurzweil Applied Intelligence Inc.	$6,500	External	●	●	○	○	3§	1,000	●	●	○	○
Voice Developer System Verbex Voice Industries Corp.	$6,550	External	●	●	●	○	4	100	●	○	○	○
Coretechs VET 3 Speech Terminal Scott Instruments Corp.	$8,995	External	●	●	●	○	3	200	○	○	●	○

●—Yes ○—No

*The TI- Speech System contains 450 on-line commands: 50 commands are in 9 vocabularies in memory at once.

†The ITT Voice Communications System contains 200 commands per file, and the number of files is limited only by the amount of disk space available.

‡Votan's VoiceCard Package contains 640 on-line commands, consisting of 64 commands in 10 vocabularies.

§Before you make the three training passes, the Kurzweil Voicesystem requires a 40-minute enrollment procedure that builds a file of your speech phonemes.

rest of Pronounce's features, from setting up vocabularies to training to loading commands into memory. Consequently all functions share the same intuitive moving-horizontal-bar menu structure, similar to that of Lotus's *1-2-3* (you select commands by moving the cursor or pressing the initial letter) but simpler because your choices are fewer.

When it comes to setting up vocabularies, Pronounce believes in the say-as-you-go plan. Vocabulary building and training occur nearly simultaneously. First you type in a command identifier, the ASCII equivalent of the speech you want to use to initiate a command. Pronounce then expects you to speak the word almost immediately, prompting you with beeps.

Once it has recorded your voice pattern—remember, all it takes is a single reading—Pronounce invites you to type in the keystrokes you wish the command to make. Each command can consist of up to 255 individual keystrokes.

Pronounce also allows you to retrain words individually or with an automatic run-through. You can also edit a vocabulary or merge two or more vocabularies. The program includes a facility to verify the accuracy of its recognitions.

Another menu selection allows you to slip all your commands into memory. You can then turn the voice recognition on and off with voice commands.

Once you've entered the main Pronounce program from the DOS prompt and exited in favor of another application, the program remains memory resident. Its text-mode menus will even pop up over graphics (if you choose the proper setup option). You can edit, modify, retrain, and verify voice commands within other applications.

The only thing you cannot do after entering PN from a hot-key or spoken command is save your changes to disk. To write to disk, you must enter Pronounce from the DOS prompt (even after the program has become memory resident). Fortunately, the changes you make in pop-up mode are preserved until you reboot your computer, so you can pop into changes and later DOS them to disk.

MEMORY MODE One welcome macro-like feature of Pronounce is its memory mode. Speaking a command—typically "memorize" but possibly anything you want to dream up—at any time or pressing the ScrollLock key when the PN program is in the foreground puts the program in recording mode. It memorizes your next keystrokes, up to a total of 255. You can then edit these keystrokes and assign them a voice command.

Although the Microphonics documentation illustrates the Pronounce hardware as a short card, the evaluation unit received was a single full-length, XT-height expansion board compatible with 8- or 16-bit data buses. The evaluation board was sparsely populated, holding a total of 17 chips. Pads were available for soldering in six memory chips in addition to the board's native endowment of two. The principal voice circuitry is made up of NEC chips.

One bank of DIP switchs on the board allows you to assign the input/output ports it uses to avoid conflicts with other hardware and make coarse adjustments of microphone input level. The only external connection on the card is a quarter-inch phone jack on its retaining bracket. Microphonics supplied a Shure SM10A boom-style headset microphone, a lightweight but high-quality choice.

Pronounce is a truly polished product—from its documentation to its elegant interface to its top-quality hardware. It would be a good choice for a modest-vocabulary, isolated-word, speaker-dependent voice-recognition system.

ROAR TECHNOLOGY
VoiceKey

In its big blue binder, Roar Technology's $1,195 VoiceKey looks rather ordinary, but its voice-recognition software includes a number of clever features that make it a simple but convenient voice-recognition system. These features include pop-up retraining and several proprietary voice-activated commands.

Its specifications put VoiceKey in the ordinary class. It is not context sensitive, even though its maximum vocabulary of 512 commands is split between four banks of 128 each. Each command can represent up to 64 individual keystrokes, communicated to the host system through the PC bus and keyboard interrupt. VoiceKey is designed to recognize only isolated words.

A single menu-driven program controls the whole VoiceKey system. This program establishes or modifies a vocabulary, trains it, and activates it for daily use.

You prepare vocabularies by entering them as a two-column list of name and keystroke sequences. Roar allows you to assign not only normal keystrokes but also some interesting proprietary functions to your voice commands.

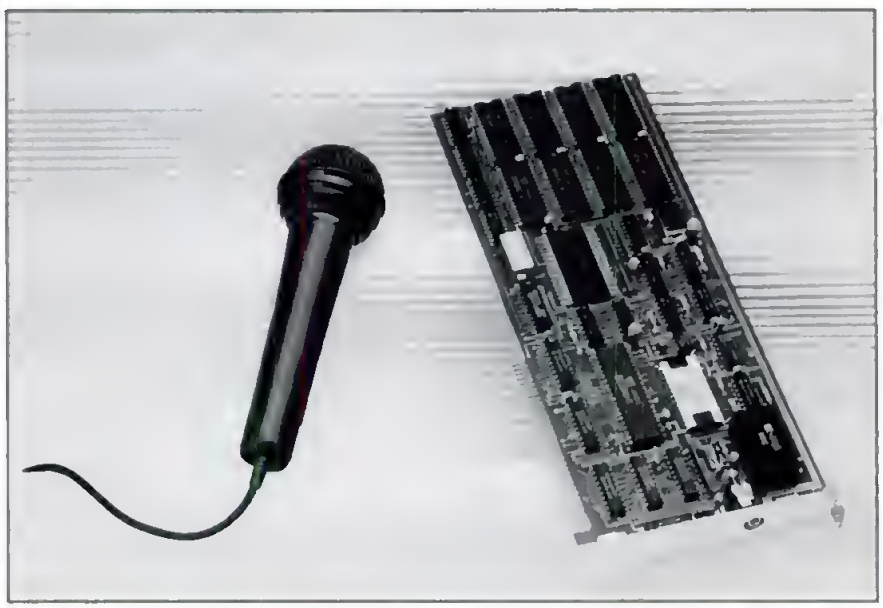
One of these functions pauses the host system to wait for any keystroke; another waits for a specific keystroke. Still other functions offer two separate CapsLock keys, reboot the system, or add a voice pause to fool software that purges the keyboard buffer. Another function switches between vocabulary banks.

The VoiceKey system comes with two

FACT FILE

VoiceKey
Roar Technology
1230 Shepherd Ave. West, Unit 2
Downsview, Ontario, Canada M3K1Z9
(800) 268-7985
(416) 638-8916
List Price: $1,195
Requires: 256K RAM, one disk drive, DOS 2.0 or later.
In Short: An internal speaker-dependent, isolated-word voice-recognition system with a 512-command vocabulary which, however, lacks context sensitivity.

CIRCLE 645 ON READER SERVICE CARD



Roar Technology's VoiceKey is a full-length expansion board, based on NEC circuits, that fits into most downsized compatibles. A phone jack on the board attaches to the Sony microphone.

Q. HOW MANY LAPTOP COMPUTER COMPANIES DOES IT TAKE

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A. ONE*

	Bondwell Model 8	Spark by Datavue	Snap 1 + 1 by Datavue	NEC Multi Speed	Toshiba T3100	Toshiba T1100 Plus	Wang Laptop	Zenith Z-183	Zenith Z-181
Micro processor	80C88	NEC V20	80C88	NEC V30	80286	80C86	NEC V30	80C88	80C86
Screen Type	supertwist LCD	supertwist LCD	supertwist LCD	supertwist LCD	Gas Plasma	supertwist LCD	LCD	backlit supertwist LCD	backlit supertwist LCD
Hard Drives	—	—	1 20M-byte	—	1 10M-byte	—	1 10M-byte	1 10M-byte	—
Internal Memory	512K	384K	640K	640K	640K	640K	512K	640K	640K
Battery Duration Time	6 to 8 hours	8 hours	8 hours	4 to 6 hours	Call for Avail	8 hours	4 hours	2 hours	3 hours
Clock Time (MHz)	4.77	4.77 or 9.54	4.77	4.77 or 9.54	4 or 8	4.77 or 7.16	8	4.77 or 8	4.77 or 8
Number of Floppy Discs	1	1	1	2	1	2	1	1	2

BONDWELL Model 8
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OUR PRICE
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With its unique detachable Super Twist LCD screen, this laptop is a breakthrough of truly small proportions. The Multispeed has more power, more memory, and twice the speed of the IBM convertible. With a weight of just over 11 pounds, folks all over town will know you're really going places.

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$1995
OUR PRICE
$1479

ZENITH Z-183
Easily upgradable, this is the laptop that gives serious users all they need. An internal 10 MB hard disk, dual speed processing, and 640K RAM plus EMS expansion capability to 1.6 MB gives the Z-183 the edge over the competition. Add these to an adjustable backlit Super Twist LCD screen and a long-life rechargeable battery, and suddenly the Z-183 doesn't really have any competition...

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OUR PRICE
$2359

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†If your Laptop arrives "D.O.A.", we will replace it, free of charge, within 48 hours of our receipt of the defective laptop (please call for R.A. no.) We will even pay all shipping and handling charges, including your cost to ship the laptop back to us.

DATAVUE SPARK

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OUR PRICE
$1209

SNAP I+ I (Not shown)

LIST PRICE
$3495
OUR PRICE
$2999

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TOSHIBA T1100 PLUS

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LIST PRICE
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OUR PRICE
$1629

WANG LAPTOP

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training options: automatic and manual. Automatic runs through the vocabulary list in order. You pronounce each command once, then a second time for verification, and the system is trained. Manual training allows you to select individual commands with cursor keys—useful, for instance, should a particular word prove troublesome or should you want to add a new word without retraining all the old ones.

Quick training is also permitted in both the automatic and manual modes. Quick training is quicker because verification is foregone, allowing you to train each command with a single pass. You can also verify each command separately.

Another menu selection loads one or more vocabulary banks into memory and activates the VoiceKey system.

Once the software is loaded, you can pop up its menus during text applications by speaking the command "Pop-up" or pressing a special keystroke combination. From each of these menus you can verify the recognition of commands without actually carrying them out, retrain individual commands, or even add new commands.

The VoiceKey hardware consists of a single expansion board about 10 inches long that uses an 8-bit interface and fits any full-length expansion slot in PCs, XTs, ATs, and even most down-sized compatibles (such as the Tandy 1000 series). The board is almost completely based on NEC circuits and is manufactured in Canada.

One DIP switch bank allows you to configure the port addresses used by the board for compatibility with virtually any other hardware. Adjusting these switches requires reconfiguring the VoiceKey software with a special utility supplied with the package. This utility also sets the microphone gain and program defaults such as the preferred vocabulary bank.

The sole external connection is a miniature phone jack for attaching the hand-held Sony dynamic microphone that's supplied with VoiceKey as standard equipment. A slide switch turns the microphone on and off. You can also use the keyboard to turn VoiceKey on and off.

Roar Technology includes four sample vocabulary templates on the single disk on which the rest of the system software is supplied. The templates include popular command sequences for *1-2-3*, *WordPerfect*, *SideKick*, and *MultiMate*.

Overall, VoiceKey is a simple and effective voice-recognition system that, within its modest limits, operates very well indeed.

SCOTT INSTRUMENTS CORP.

Coretechs VET 3 Speech Terminal

Scott Instruments Corp. calls its $8,995 Coretechs VET 3 a speech terminal because, like a VDT (Video Data Terminal), the self-contained desktop unit plugs into and controls a host computer through a standard RS-232 connection. The speaker-dependent Coretechs VET 3 Speech Terminal is designed to recognize both isolated commands and connected speech and to relay those commands in ASCII form to its computer host. It can also speak by playing back digitized voice recordings.

Although the Coretechs VET 3 is designed to functionally replace a standard VDT, you actually need a VDT to set it up. For PC users, Scott Instruments supplies a terminal emulator that runs on a PC as a handy substitute.

The Coretechs VET 3 works by presenting commands to the computer's serial port, while special software polls the port and acts upon the received input.

Turn on the VET 3 and, like the computer it really is, it boots itself up from its own firmware, then immediately types its main menu on the screen of the connected VDT. By necessity a text-only display, the menu gives you a choice of functions: Vocabulary, Recordings, and Settings.

Select the Vocabulary function, and you can build a set of identifiers and associated commands, train them, and put them to work. Scott Instruments recommends at least three trainings for each command in the vocabulary, and the Coretechs system enforces that rule. You cannot exit from training (and use your results) without at least three passes.

The Vocabulary menu allows you to create or add to vocabulary lists and to train commands—both individually and in groups. Adding a command does not re-

Scott Instruments' Coretechs VET 3 Speech Terminal is a self-contained 4- by 18- by 17-inch unit that plugs into and controls the host computer through a serial connection.

FACT FILE

Coretechs VET 3 Speech Terminal
Scott Instruments Corp.
1111 Willow Springs Dr.
Denton, TX 76205
(817) 387-9514
List Price: $8,995
Requires: 256K RAM, two disk drives, DOS 2.0 or later.
In Short: A heavy-duty external minicomputer-style connected-speech voice recognizer adapted to PC use through software. With its built-in voice digitization, it can respond verbally to input speech.

CIRCLE 644 ON READER SERVICE CARD

quire retraining of all other commands. You can also check and verify the recognition accuracy of each command.

The VET 3 has no nonvolatile method of its own for storing what you train. Turn the power off, and it forgets its lessons. However, the terminal does have facilities for uploading the training information to the host computer and downloading it back into the VET 3. Scott Instruments supplies a simple program that implements this storage method, again using a PC as the host. Because of the serial connection, this process is time-consuming and can take several minutes.

The Coretechs VET 3 can memorize a maximum of 200 commands, but the actual number of commands the system can handle depends on their length (commands can have a maximum length of 3 seconds) and the number of digitized voice recordings (up to 100) that you've made with the system.

As with most external voice-recognition systems, the Coretechs VET 3 sends only ASCII codes to its computer host; nor does it delve down to the keyboard scan-code level. Scott Instruments also includes a program with the system that transforms serial port input into its equivalent keystrokes. This software appeared to be a quick effort. For example, its only documentation was a single disk file; there was nothing available in print.

TRAINED TO TALK BACK The Recordings menu allows you to record phrases up to 2 seconds in length that it will give in response to recognized voice input. The Coretechs VET 3 allows the response to be either an echo of the trained command or something completely different. The system will also utter its bon mots in response to commands sent from the host computer.

The Settings menu allows you to adjust for the background noise level (microphone gain is set with a front panel potentiometer), speech-compression rate (for voice recordings with a range of 4,800 to 32,000 bits per second), and the recognition threshold (how stringent the pattern match must be for recognition).

The Coretechs VET 3 features four operating modes.

- Transparent mode connects the setup terminal, which is hooked to the unit, directly to the host computer. The VET 3 essentially does nothing and merely eavesdrops, waiting for the command sequence to pop it into action.
- In Keyvet mode, the VET 3 and its attached VDT operate in parallel, sending typed or voice-recognized characters to the host computer as they are received.
- In Command mode, the VET 3 listens, and upon recognition of spoken words sends the appropriate ASCII strings to the host computer.
- Local mode is used for setting up vocabularies and recordings.

Physically the Coretechs VET 3 is a medium-sized (4- by 18- by 17-inch HWD) aluminum box painted beige. The evaluation unit was adapted to mount in a standard 19-inch rack with a panel height of 5¼ inches.

The front panel includes several user controls for speaker volume, microphone gain, and an on/off reset keyswitch. Push-button switches mute the speaker and put the VET 3 into Local mode. The rear panel includes two BNC connectors for an FM wireless microphone-and-headset link in addition to two male DB-25 connectors for hooking up the host computer and a VDT. You set the operating parameters of these ports using several banks of DIP switches on the rear panel.

The Coretechs VET 3 system is a computer in its own right, based on an MC68000 16-bit microprocessor, 256K bytes of DRAM, a self-contained power supply, and seven proprietary-bus expansion slots, four of which come filled with boards. The hardware implementation is extremely well done and of top quality.

The system comes with a Shure VR230B headset (with headphones) and boom microphone combination. The headset plugs into the front panel of the Coretechs VET 3 unit.

The Coretechs VET 3 is an industrial-strength voice recognizer. But because of its need for a VDT during set up, it's more suited to minicomputer applications than to PCs.

TEXAS INSTRUMENTS
TI-Speech System

Texas Intruments' first venture into voice technology was launched in 1978, when the company came out with Speak & Spell, a popular children's toy that let kids punch in letters and would then pronounce the word. From this humble beginning, TI became one of the first companies to lend ears and a voice to the PC.

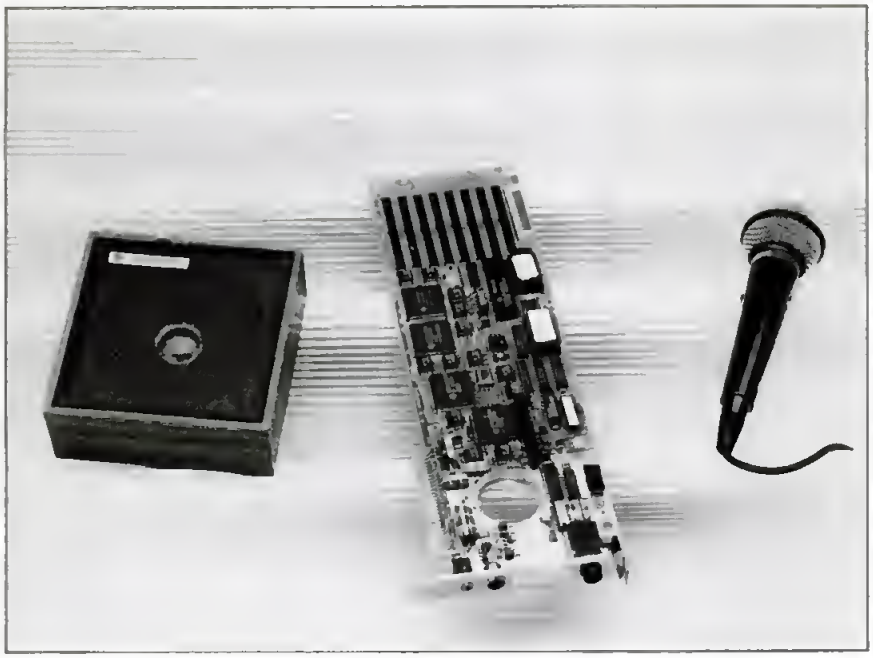
Texas Instruments now ranks among the leaders in the field of speech technology. The technology of the $1,150 TI-Speech System reflects that heritage. The system offers PC users a wide variety of speech-handling abilities including voice recognition, voice digitization, and text-to-speech processing.

Although the Texas Instruments hardware embodies all three capabilities with equal refinement, the TI-Speech System

FACT FILE

TI-Speech System
Texas Instruments
P.O. Box 809063
Dallas, TX 75080-3500
(800) 527-3500
List Price: $1,150; TI-Speech Phone Manager, $350, TI-Speech Applications Toolkit, $300, TI-Speech SIDR software, $150.
Requires: 256K RAM, hard disk, DOS 2.0 or later
In Short: An all-purpose internal voice recognizer with connected-speech, voice-digitization, and text-to-speech processing abilities that can pool up to eight voices for a degree of speaker independence.

CIRCLE 643 ON READER SERVICE CARD



The Texas Instruments TI-Speech System hardware includes an expansion board that plugs into an 8- or 16-bit slot. The board has connections for a headset, microphone, and loudspeaker.

software gives its greatest support to the voice recognition feature. The package includes everything necessary to allow you to fully implement a complete voice-recognition system based on pattern-matching algorithms.

The system offers three modes of operation: connected-speech, isolated-word, and immediate-speech recognition. The last mode is similar to connected speech, but in it the system executes a command as soon as it recognizes one.

The software part of the TI-Speech System consists of a small memory-resident program and a Voice Manager that builds, edits, and maintains its vocabulary. The Voice Manager runs as a normal system application from the DOS prompt, but loads the vocabularies to be used into memory.

The first step in putting the TI-Speech System to work is entering the vocabulary and associated commands into the Voice Manager. Since the process is entirely prompted, it should be accessible even to inexperienced users. The TI-Speech System supports up to nine vocabularies with up to 50 commands each. Each command can have a sequence of 40 characters with a 40-character identifying phrase.

Training is also prompted, and the system steps through the entire vocabulary as you pronounce each word. TI recommends at least three passes for optimal recognition. You can single out individual words for additional repetitions. The system monitors its recognition and gives you a 1-through-10 score as a reliability index for each word recognized.

Later you can add a new word to a vocabulary without retraining all the old ones. You can also alter individual voiceprints—the speech patterns that are recognized—whenever you want in case recognition becomes unreliable.

NOT CONTEXT SENSITIVE Despite its multiple vocabularies, the TI-Speech System is not truly context sensitive. Instead, the system gives you two methods of changing vocabularies. One uses the Voice Manager, which means exiting your current application and loading Voice Manager every time you want to change vocabularies. The other method allows you to change vocabularies within applications by specifying one particular voice command to make the switch.

The other operational areas of the TI-Speech System—text-to-speech processing and voice digitization—are not supported as end-user applications by TI. However, these features can be brought to life by independent software developers and other people building their systems around TI-Speech. TI supplies a programmers' guide and device drivers for implementing software that makes use of these abilities through a programming language such as BASIC.

Text-to-speech processing uses voice synthesis and some clever and elaborate algorithms to convert standard ASCII text files into voice-like utterances. Despite a definite machine sound, the words are recognizable.

The voice-digitization feature converts speech to digital data and back again, allowing you to use disk drives as tape recorders. The TI-Speech System supports several degrees of data compression (the more compression, the worse the quality) to squeeze 1 second of audio into from 2,400 to 32,000 bits.

All of these capabilities are implemented on a single full-length, XT-height expansion board that plugs into any 8- or 16-bit slot. Although the board is designed primarily for TI Business-Pro and TI-PC computers, a bank of DIP switches allows you to configure the hardware for IBM PCs, ATs, and compatibles.

The TI board has connections for a headset, a microphone, and a loudspeaker. Optionally, you can connect a telephone to the TI-Speech System using the TI-Speech Phone Manager software and the TI-Speech Phone Interface Board, which is a daughtercard that adds two RJ-11 jacks to the speech board.

The TI-Speech Phone Interface Board extends the abilities of TI-Speech to telephone dialing, answering, tone signaling, tone detection, and using the telephone deskset for speech input and output. The TI-Speech System can also recognize speech during telephone calls, if desired.

The TI-Speech System is both a useful product and one that provides fodder for developers and experimenters. Although its lack of context sensitivity can be a shortcoming in many applications, its connected-speech abilities can more than make up for that limitation.

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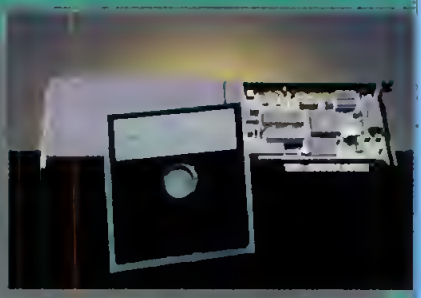

The ***Plus Hardcard***™ is an ideal hard disk subsystem. Since it's only 1" thick, it fits into a single slot, leaving the others wide open for other possibilities. Choose a 40MB or 20MB version; it's fully compatible with most PCs including IBM's new System/2 Model 30.™ A great way to expand without taking up a lot of room.

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CIRCLE 262 ON READER SERVICE CARD

VERBEX VOICE INDUSTRIES CORP.

Voice Developer System

Consisting of a Voice Recognizer Series 4000 standalone voice-recognition terminal plus various programs, the $6,550 Voice Developer System from Verbex Voice Industries Corp. resembles a downsized PC and its cartridge slot.

The Voice Developer System's impressive connected-speech voice-recognition abilities include macro pattern-matching. That is, the Voice Developer System recognizes not only distinct voice patterns within words but also patterns of words themselves. Using a grammar that a system manager defines, it can take advantage of its macro pattern-matching abilities to hone its word-recognition accuracy. In effect, it operates as a primitive system for recognizing words from their context.

The cartridge slot reveals that one of the principal homes Verbex expects for its Voice Recognizer Series 4000 terminal is in industry. The rugged, solid-state cartridges store the voice patterns of operators as well as the master definition of the system grammar. Because it allows switching cartridges, the Series 4000 terminal can recognize the voices of various operators despite being speaker dependent.

The cartridges contain low-power CMOS (complementary metal oxide semiconductor) memory chips that internal batteries, which are not user-serviceable, keep powered up for about 5 years.

Solid-state memory cartridges mean no moving parts to gum up in hostile industrial environments, and the cartridge format essentially allows users to reprogram the system without their even having to know what a computer is.

The rest of the Series 4000 terminal is similarly designed for such no-brains operation. Its all-important mode switch is hidden on the rear panel so that only the cartridge slot and the microphone cable are presented to the user.

Setting up the system requires several steps and a division of labor between a manager and an operator.

The first step is designing the grammar of the system. More than being merely a list of vocabulary words, the grammar is a set of rules governing the way the words of the vocabulary interrelate. Beyond simply stacking menus to make them context sensitive, the Voice Developer System understands relationships among words and the number of words required for a complete response. It does not complete processing a command sequence until it hears the entire group of words, relying on short and long pauses and word-positioning rules to know what to listen for.

The Voice Developer System, a standalone terminal, connects to a PC via a DB-25 connector. Cartridges store operators' voice patterns and a master definition of system grammar.

The manager defines the Voice Developer System grammar using a proprietary symbolic notation system (which is essentially a small-scale programming language), and a word processor that produces ordinary ASCII files.

The grammar also includes commands that you send to a host computer over a serial data line. The Voice Developer System allows you to send standard ASCII characters as well as PC function keys—but not function key combinations—to the host.

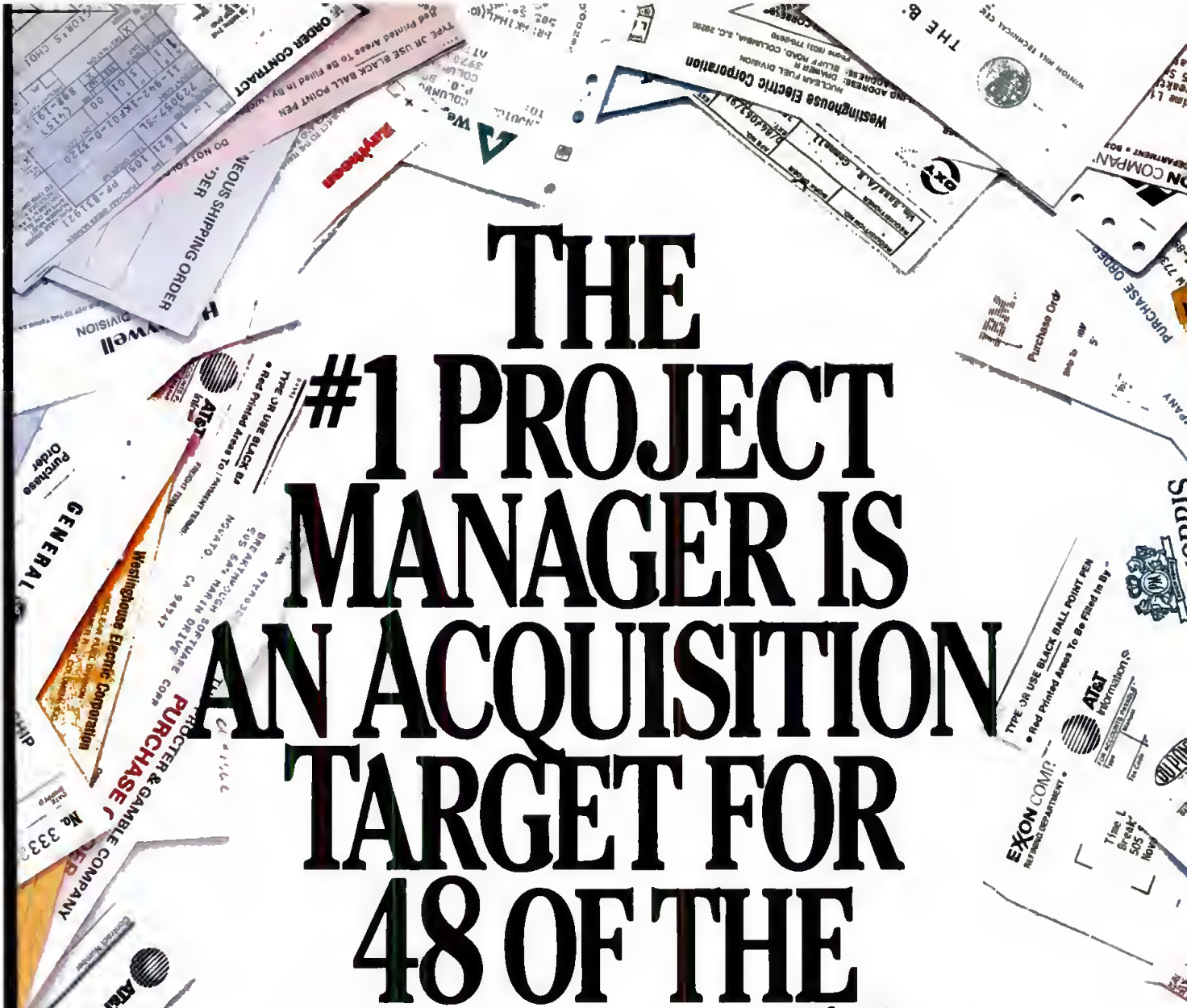
Once the grammar is set up, a program called TRANSFER compiles and sends it to the terminal through a serial connection. TRANSFER also detects and reports grammatical errors. The compiled grammar is stored on a Verbex cartridge called the master cartridge.

An operator—who may not necessarily be the manager who set up the grammar—trains the system to recognize his own voice. Using an ASCII terminal or a PC-based terminal emulator to provide instructions and prompt for voice responses, the operator first loads the data from the

FACT FILE

Voice Developer System
Verbex Voice Industries Corp.
10 Madison Ave.
Morristown, NJ 07960
(201) 267-7507
List Price: $6,550; Voice Recognizer Series 4000 terminal alone, $5,200.
Requires: 256K RAM, one disk drive, DOS 2.0 or later.
In Short: An external voice recognizer with a very complete grammatical control system and a connected-speech ability that can handle multiple voices through plug-in cartridges.

CIRCLE 642 ON READER SERVICE CARD



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CIRCLE 745 ON READER SERVICE CARD

master cartridge, then slips a blank cartridge into the Series 4000 terminal.

Firmware inside the terminal runs an enrollment session during which the operator speaks each word of the entire vocabulary twice in a quiet area. Next the operator trains the system by speaking the vocabulary as connected speech, first in a quiet area then in the presumably noisier area, in which the Series 4000 is to be used.

You can later extend the vocabulary and retrain individual words without retraining the rest of the vocabulary. The system also allows separate verification of recognition accuracy.

LIMITED UNDERSTANDING The system suffers from a few limitations. It will understand a maximum vocabulary of only 100 words. Overly complex grammars may require so much processing time that the Voice Developer system will be unable to keep up—it just freezes. Although the TRANSFER program attempts to indicate how complex a grammar is, only actual operation will determine whether the grammar can be used successfully.

The macro pattern-recognizing ability of the Voice Developer System minimizes errors. Moreover, it helps the machine sort conversation from command sequences, so there's almost no need to switch its recognition on and off. Nonetheless, the Shure VR230 headphone/boom microphone combination that accompanies the Series 4000 terminal was equipped with a locking/momentary push-to-talk switch.

The whole system fits into a 4- by 17- by 15-inch box that's finished in PC-like two-tone gray-beige. On its front panel are the cartridge slot at right, a microphone jack on the left, a Ready LED, and a reset switch.

The controls and connectors are in the rear: a power connector, a female DB-25 to connect to an ASCII terminal, a male DB-25 to tie in the host computer, a jack for earphone audio input, and a volume control switch. Two DIP switch banks configure the parameters of the two serial ports, and a three-position switch changes system modes between transferring data and actual operation.

All of the system electronics (save the internal power supply) fit on a single planar board that fills nearly the entire bottom of the steel case of the Series 4000 box. Design and construction quality are exemplary.

The Voice Developer System is complex and difficult to set up, and its vocabulary is quite limited. However, it more than makes up for these limitations with its ability to recognize connected speech. It's one of the most advanced—and most unusual—voice recognizers currently available.

THE VOICE CONNECTION
IntroVoice VI

Combining voice recognition and text-to-speech synthesis, The Voice Connection's $595 IntroVoice VI system turns any PC, XT, or AT into a complete voice-controlled workstation. A speaker-dependent, isolated-word system, it allows full context sensitivity and has a generous maximum on-line vocabulary of 400 commands that can be divided into 200 subvocabularies.

Command responses are almost unlimited—up to 2,000 keystrokes each, and spoken text responses can consist of as many as 400 characters. Pop-up help and maintenance is constantly available.

Setup and control of the IntroVoice VI system is completely menu driven, and several sample vocabularies are included with the system (including one with spoken input for every possible keypress).

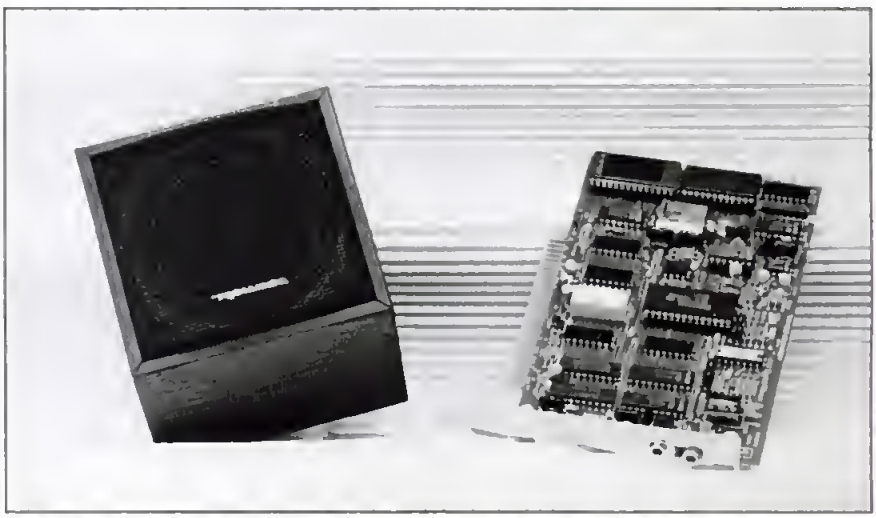
As with most such systems, the first step in putting IntroVoice VI to work is creating a vocabulary. After selecting the proper option from the overall Voice Utility Program (or VUP) that controls the system, you are presented with a three-part screen. For each command you want to add to the vocabulary, you first type in the command name, then the keystroke sequence it is to elicit (as well as the voice response, if you want one), then you list the subvocabulary that you want the command to invoke. One command can activate several subvocabularies, and you can define certain commands as universal or active for all subvocabularies.

After you've set up a vocabulary (or

PC MAGAZINE FACT FILE

IntroVoice VI
The Voice Connection
17835 Skypark Circle Suite C
Irvine, CA 92714
(714) 261-2366
List Price: $595
Requires: 100K RAM, one disk drive, DOS 1.0 or later.
In Short: A well-thought-out internal isolated-word voice-recognition system that's context-sensitive and speaker-dependent; it features a 400-word vocabulary.

CIRCLE 641 ON READER SERVICE CARD



The Voice Connection's IntroVoice VI expansion card fits into any 8-bit slot, even XT short slots. It uses the Interstate Electronics ASA-16 voice-recognition chip and provides two jacks.

just part of one), you must train the system. Again, the IntroVoice VI system is entirely ordinary. It prompts you to say each command in turn. The system generally requires three passes, although you can override this number. You can retrain individual commands at any time. In addition, the IntroVoice VI system allows you to test the recognition of any command.

In normal operation, a single batch file allows you to load the three memory-resident programs necessary to bring the IntroVoice VI system to life: two for text-to-speech synthesis and one for voice recognition. A separate program loads a vocabulary into the system.

Because voice patterns are stored under both the vocabulary name and the trainer's initials, several individuals can use one IntroVoice VI system and vocabulary as long as each trains his own voice commands.

You can turn voice recognition on and off by voice or by pressing either the NumLock or ScrollLock key (you define which one when you set up the IntroVoice VI system).

In operation, the IntroVoice VI pop-up menu system supplies help by listing as many as 30 commands on-screen at a time. It also allows adding, training, retraining, or verifying commands within other applications.

The IntroVoice VI system also includes a utility for direct text-to-speech conversion. This program, called SAY, echoes any text that is typed after the program name on the command line.

The hardware side of the IntroVoice VI system includes a single small expansion card that fits into an 8-bit slot, including XT short slots. Its primary circuit element is the Interstate Electronics ASA-16 voice-recognition chip.

According to The Voice Connection, the IntroVoice VI system steals about 14 percent of the microprocessor time of its host computer when in operation.

Only two connections are provided on the card-retaining bracket: a quarter-inch phone jack that accommodates a user-supplied microphone and a miniature phone jack for text-to- speech output, typically an earphone. An on-board DIP switch bank allows you to configure several hardware options, including the interrupt used by the board and its I/O port address.

Although simple, IntroVoice VI can add the voice features most in demand to any PC. It's a good introduction to voice technology, as well as being a completely workable system.

VOTAN

VoiceCard Package VPC2150

Votan's *VoiceKey* is a software package that becomes a complete voice-recognition system—the VoiceCard Package VPC-2150—when coupled with the company's PC expansion board, VoiceCard. The complete $2,700 VoiceCard Package expands on most speaker-dependent, isolated-word recognition systems by adding context sensitivity, voice digitization for recording and playback, and even a telephone connection.

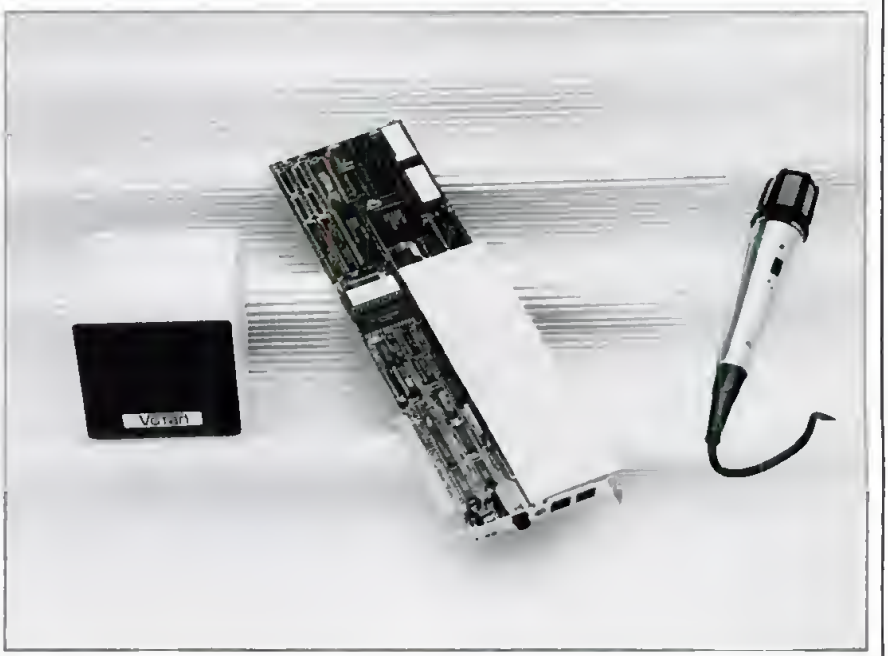
A primary aim of the Votan VoiceCard Package is to minimize the training required for its 64-command repertory. An experienced user can train each command with a single pass. In fact, Votan recommends no more than three training passes (two giving the command word in isolation, one in connected speech). Rather than averaging them, the system stores each voice pattern of a command individually, and memory space on the VoiceCard for voice patterns is limited.

Although the 64-command vocabulary might seem restrictive, any of those commands can switch the system to an additional ten vocabularies that are ready and waiting. This vocabulary switch is quick, accomplished by replacing the template in VoiceCard memory with one stored in the host computer's RAM.

FACT FILE

VoiceCard Package VPC2150
Votan
4487 Technology Dr.
Fremont, CA 94538
(415) 490-7600
List Price: $2,700 (includes *VoiceKey* software).
Requires: 128K RAM, two disk drives, DOS 2.0 or later.
In Short: A microprocessor-based internal isolated-word speaker-dependent voice-recognition system with built-in digitization that trains with as little as a single pass.

CIRCLE 640 ON READER SERVICE CARD



Votan's VoiceCard Package VPC2150 expansion card fits into a full-length, XT-height expansion slot and uses an 8-bit data bus. It is based on a TMS32010 microprocessor.

IMS-286

10 MEGAHERTZ

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Base System

- Intel 80286 processor running at 10MHz, switch selectable to 6MHz
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- 200-watt power supply
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10MHz, 70MB MonoGraphic System. $2099

- 10MHz monographic system featured above, plus:
- 70MB fast access (28ms) MiniScribe hard disk
- SpeedStor partitioning software

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- 150-watt power supply

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10MHz, 30MB MonoGraphic System. $1039

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- Reliable 30MB MiniScribe hard disk system with Western Digital RLL controller

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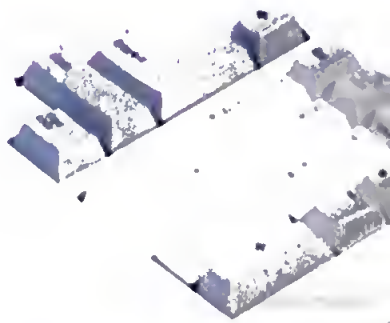

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You can also use one command to limit recognition of the commands that follow, endowing the Votan system with context sensitivity. Limiting the field hastens recognition and helps weed out near-hits.

Besides sending nearly any keystroke sequence to the host computer through the PC bus and keyboard interrupts, *VoiceKey* can also issue voice responses. Using the digitization abilities of the VoiceCard, you can record responses with any of six degrees of quality (requiring from 4 to 24 kilobits per second of storage). In the complete *VoiceKey* system, responses include spoken acknowledgments of commands or requests for confirmation of dangerous commands.

Other included software can turn the Votan VoiceCard into a digital recording-and-playback system for applications that include telephone answering systems and voice-in/voice-out dictation systems. An example of the former style of program is Votan's PC Telephone Professional.

After a quick hardware installation that consists of plugging in the board, putting the VoiceCard Package to work is a three-step process. First, you must construct a vocabulary using a fill-in-the-blanks program. Key words are listed first, then you fill in the sequences of keys that will be sent to the host computer; these can be up to 64 characters long.

Finally, you train the completed vocabulary, with *VoiceKey* prompting you to speak each command with on-screen text and a beep. Although one training is sufficient, you can add more, including speaking the command in a string of connected speech. You can also retrain individual words.

ACCURACY TEST Votan includes a facility for testing recognition accuracy—a simple text-mode speedometer-style scale that shows the "recognition winner" and the "runner-up." From this display you can judge how well a command was recognized and how well the winner and runner-up could be distinguished.

Built into the VoiceCard Package are special task words with dedicated functions for turning voice recognition on and off and eliciting a pop-up version of the *VoiceKey* software while another application is running. Using this pop-up program, you can view command menus as well as train and verify individual commands.

The VoiceCard itself requires a single, full-length, XT-height expansion slot and uses an 8-bit data bus. Its sophisticated capabilities are based on a 32-bit Texas Instruments TMS32010 microprocessor.

The retaining bracket of the card provides a quarter-inch phone jack for microphone input and a miniature phone jack for headphone or speaker output.

Telephone interface circuitry is located on a daughterboard that adds RJ-11 jacks for connecting the telephone line and a standard telephone deskset.

You can install up to three Votan VoiceCards in a single computer; each can operate independently and can recognize a different voice. Although the three cards can share the same vocabulary, they must be trained separately and require you to reset defaults, such as the interrupts used.

All in all, digitization makes this system versatile; single-pass training makes it easy to set up and use.

XTRA BUSINESS SYSTEMS

ITT Voice Communications System

Made by Xtra Business Systems, the $1,350 ITT Voice Communications System adds a variety of voice-recognition and voice-digitization functions to its host computer system.

Like nearly all voice-recognition products, the ITT Voice Communications System gives voice-activated keyboard input to nearly any application. It recognizes up to eight voices per file, and you can store up to 200 commands per file. The number of files you can have is limited only by the amount of disk space you have available. Also, the system's built-in voice digitization circuitry can turn a PC into a telephone-answering and -dialing machine; it can even record dictation as if it were a tape recorder.

The ITT Voice Communications System's voice-recognition and -digitization functions are also distinct operationally. For instance, it will record messages from the telephone but will not allow you to send voice commands through the telephone.

Commendably, the voice-recognition system is context sensitive. Commands are grouped in levels, and the system can recognize only those individual commands present in the currently active level. You can switch levels automatically using the voice commands or manually through keyboard selection using a memory-resident program.

After you install the hardware by plugging in the board, the first step in setting up the ITT Voice Communications System is to create a file of command names, the keystrokes they simulate, the level of each command, and the next level the command switches into. You generate this file with an ordinary user-supplied text editor such as Edlin or *WordStar* in its nondocument mode. However, you must be careful with syntax when you set up the command-name file since the system is as unforgiving of syntax errors as is BASIC.

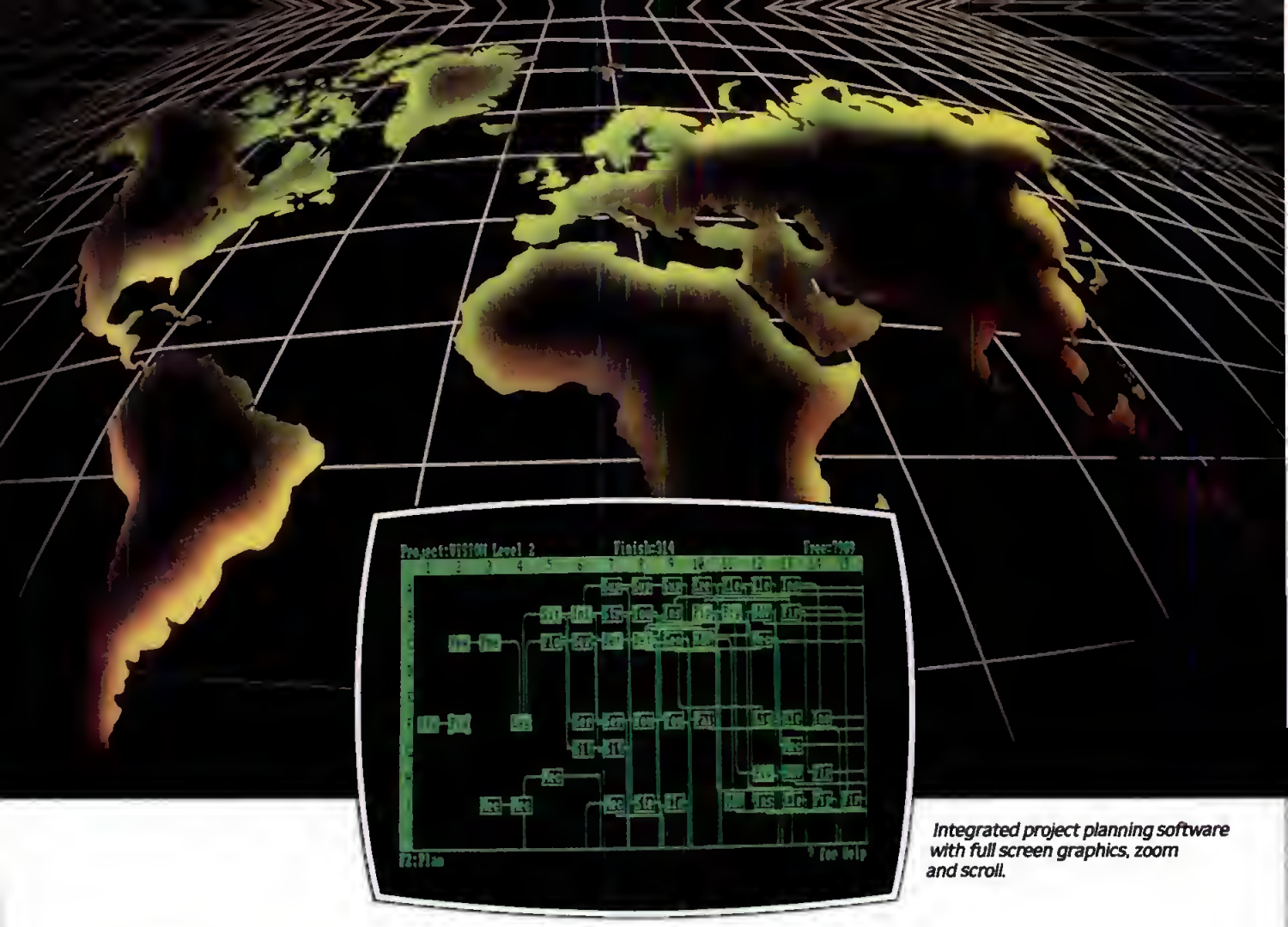
Command strings can be up to 126 characters long. Although Xtra Business Systems does not publish a maximum number of commands that the system supports (because the number varies with the length of the commands), its memory usage indicates that it should be able to handle several hundred command entries without any fuss.

Once you create a vocabulary file, you must parse it into usable form using a program supplied by Xtra Business Systems. After parsing, each command in the vo-

PC MAGAZINE FACT FILE

ITT Voice Communications System
Xtra Business Systems
2350 Qume Dr.
San Jose, CA 95131
(408) 945-8950
List Price: $1,350; headset, $125; microphone, $125.
Requires: 256K RAM, one disk drive, DOS 1.0 or later.
In Short: A complete internal, context-sensitive system with voice recognition, digitization, and text-to-speech synthesis that allows pooling of isolated-word voice patterns for a degree of speaker independence.

CIRCLE 639 ON READER SERVICE CARD



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CIRCLE 173 ON READER SERVICE CARD

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The board for the ITT Voice Communicotions System uses o TMS32010 processor for voice manipulotion ond an 80C88 for overall control. It plugs into o single 8- or 16-bit slot.

■ The ITT Voice Communications System accommodates multiple users by pooling voice patterns into a file usable by all who contributed to it.

cabulary must be trained using another program supplied with the product.

The parsing program is intelligent enough to understand simple additions or deletions from the vocabulary file and requires that you train only new words rather than retraining the entire vocabulary.

The system's training program works like most, calling words to the screen for you to pronounce in sequence. Words are presented either in random order (the preferred mode) or alphabetically. Various provisions are made for eliminating mispronunciations and monitoring recognition quality. Xtra Business Systems recommends four or more trainings for each word.

The ITT Voice Communications System accommodates multiple users by pooling voice patterns. Each user trains the system independently using the same vocabulary file. Then all voice-pattern files are brought together using a special pooling program that produces a single recognition file usable by all the individuals contributing to the pool.

Starting the ITT Voice Communications System is a simple two-step process that involves first loading a memory-resident program, then loading the vocabulary. The system provides you with several options, such as issuing a beep when the system recognizes each word, as well as the ability to program microphone gain levels via the keyboard.

MESSAGE-HANDLER Also included in the Voice Communications System is a set of programs called the Voice Executive, which includes a calendar and reminder system.

The Voice Executive can also turn a PC into an telephone-answering machine. It can digitize your voice as an answering message, and digitize and record voices calling in over the telephone. Included is a complete message management system that allows you to annotate both outgoing and incoming messages with up to 18 characters. It also lets you select one of many outgoing messages to use for different occasions, as well as to erase, copy, and archive messages. The system also allows you to set volume levels, message lengths, and the number of rings after which to answer. The Voice Executive will also serve as a telephone directory and auto-dialer.

You can use many of the Voice Executive's functions from the DOS prompt. The Voice Executive itself operates in the background and can be called up at any time.

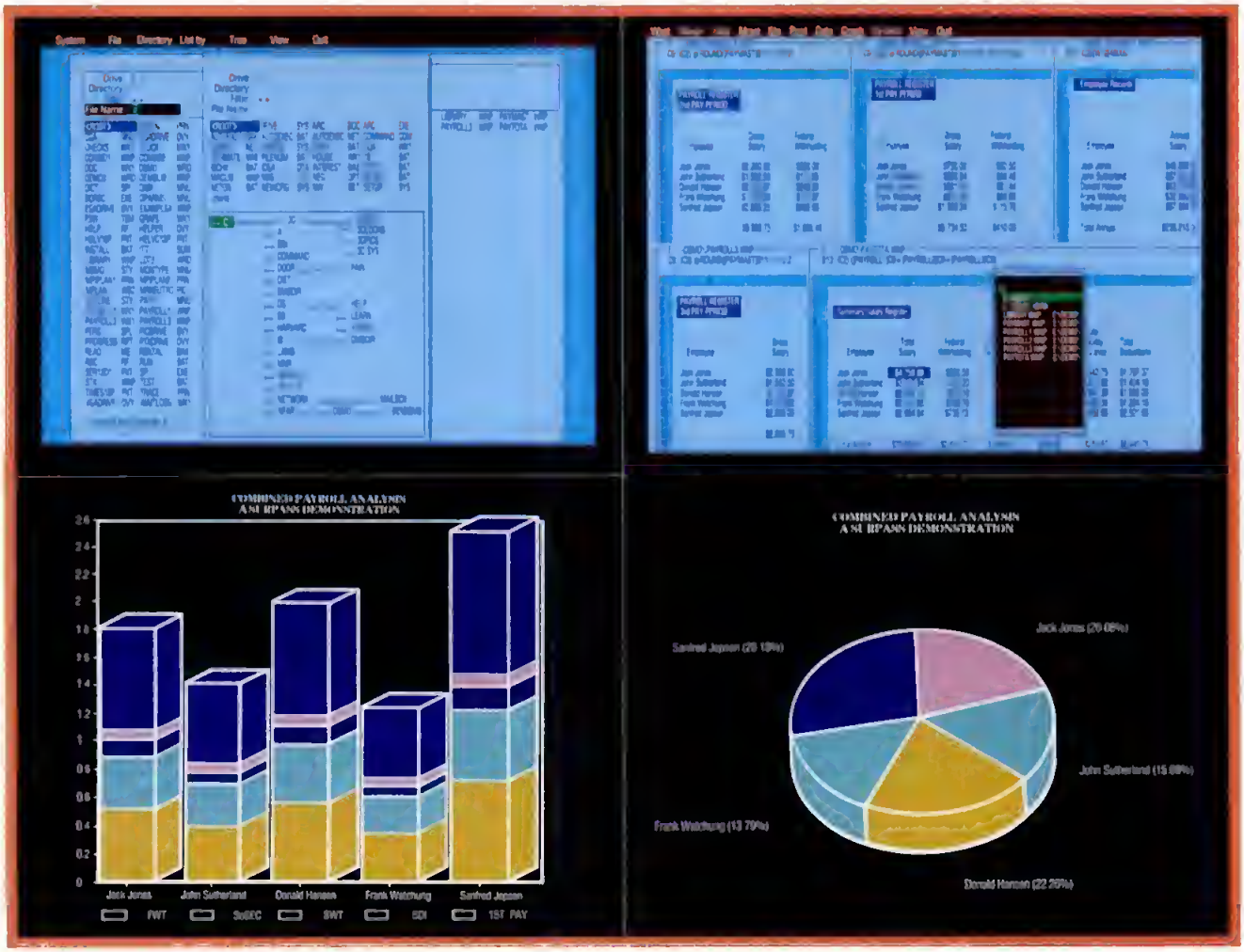
You can also use the voice digitization circuitry of the ITT Voice Communications System with the microphone and speaker of the voice-recognition system to turn your PC into a dictation machine. According to Xtra Business Systems, one floppy disk is good for recording about 6 minutes of speech.

All of these capabilities have been squeezed into one tightly populated, full-length, XT-height expansion board that will plug into a single 8- or 16-bit slot. Among its circuitry are a TMS32010 processor for voice manipulation and an 80C88 for overall control. Four connections are supplied for linking to the outside world: RJ-11 jacks for telephone line and deskset, a miniature phone jack for a microphone, and a subminiature jack for a speaker.

At a separate price, Xtra Business Systems supplies either a gooseneck microphone/speaker add-on or a headset/boom microphone for use with the Voice Communication System. A DIP switch bank allows configuring the VCS board to avoid hardware conflicts.

Overall, the ITT Voice Communications System is a workable all-in-one voice management system that can be adapted to a wide variety of applications. PC

Winn L. Rosch is a contributing editor of PC Magazine.



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A New Page for MultiMate?

With a new release of MultiMate, Ashton-Tate plays catch-up with the word processing giants. Is it too late?

When Ashton-Tate acquired *MultiMate* in 1985, the package's Wang roots and corporate orientation had made it a best-selling word processor. Since then, however, *MultiMate* has stood still as its competitors—principally *Microsoft Word* and *WordPerfect*—have added improvements that vaulted them ahead of the Ashton-Tate product.

Much of what was missing from past releases is now present in *MultiMate*'s latest update. New features include pull-down menus, laser printer support, a *dBASE* merge function, auto-hyphenation, footnoting, an undo capability, and ASCII file import. But the package still doesn't have some features offered by its competitors; there are no style sheets, no mouse support, and no split-screen capability. More discouraging is *MultiMate*'s stolid retention of its page orientation, the biggest sore point with would-be users.

MultiMate Advantage II comes on 11 disks, takes up 384K of memory, has nine manuals, and lists for $565. (At review time, street prices ranged from $299 to $450.) The product is the flagship of the *MultiMate* line, which includes a pared-down version that runs on 256K of memory and costs $495, and LAN versions of both products. Upgrade cost for current users of *MultiMate* is $100.

MultiMate's roots are probably familiar to most, but they're worth recapping because they're most likely responsible for some of what is wrong with the product today. *MultiMate* was underwritten by the Connecticut Mutual Life Insurance Co. in 1982 to provide a bridge from dedicated

■ MULTIMATE ADVANTAGE II

Wang word processors to PCs. Other corporations welcomed a program that didn't require retraining when workers switched from a Wang system to a PC, and the program quickly became popular. Unfortunately, as the PC word processor market evolved, *MultiMate* retained many of its Wang-like characteristics, which made it more rigid than other contenders for the corporate market—*WordPerfect*, *Microsoft Word*, *WordStar*. This inflexibility is most obvious in *MultiMate*'s page orientation.

A page-oriented word processor saves each page of text to disk as it's completed, which means you can't see the bottom of one page and the top of the next at the same time and you can't scroll through pages quickly because each one has to be retrieved from disk as you call for it. If you add lines of text to a completed page, the program won't adjust the text automatically; it will simply tack on the text to the bottom of the page, ignoring page length settings. To have the text spill over onto the next page, you have to give a repagination command. Document-oriented packages like *Microsoft Word* and *WordPerfect* treat a word processing document as one continuous file, allowing you to scroll quickly, jump from the beginning to the end of the document smoothly, and forget about page breaks until you're ready to print.

Ashton-Tate says *MultiMate* now offers document-oriented word processing. This is partly true. If you operate the new *MultiMate* in what it recognizes as document mode, it will no longer save each page as you finish it; and you can see portions of two pages at once. But, unlike word processors with true document orientation, *MultiMate* continues to store added material on the current page, pushing the bottom margin below the set limit. To fix it, you still have to use the repagination command.

GOVERNMENT COMPATIBLE *MultiMate* is compatible with formats popular in large installations and in government work (the program is used by several government agencies, including the Defense Contract Audit Agency and the National Institutes of Health); it will import DCA, Honeywell, and .DIF files, including those in NAVYDIF format, the standard word-processing interchange for the U.S. Navy. *MultiMate* will convert *WordStar* and *1-2-3* files, and there is now an ASCII file import function. *dBASE* .DBF files can be accessed directly through *MultiMate* using the *dBASE* merge option. To access a file, you define a block in the merge document and type in the name of the *dBASE* file you want, and it will be called into the *MultiMate* document. No file conversion is needed.

The Wang-like commands take some getting used to, and there's no editing menu on the screen. You center with the F3 function key. Hold down the Ctrl key and type a dash and you'll get a double underline. Boldface is Alt-Z. Press the Delete key and the program will ask you "Delete what?" Stick-on key labels, keyboard templates, and giant reference cards are attempts to make the structure more comprehensible.

The new pull-down menus are a step in the right direction. They're accessed by typing Alt-L. The problem is that only a few of the hundreds of commands are to be found on the menus. You can search from one to another for minutes, only to be forced in the end to resort to a reference card, help screens, or one of the manuals after all.

There are no style sheets, as *Microsoft Word* terms them, or format files, as they're called in *WordStar 2000*, to allow you to preset margins, line spacing, and fonts for commonly used document formats. There is no windowing capability. The maximum line length, despite complaints from users, is still 156 characters. The maximum length of any document is 128K (about 60 pages); *Displaywrite 4* allows up to 2.4 megabytes, and file lengths in *Word*, *WordPerfect*, and other packages (see features table) are limited only by disk space.

Like most of its competitors, *MultiMate* has a built-in spelling checker and thesaurus. Both have large Merriam-Webster dictionaries (the spelling checker's is 100,000 words, the thesaurus draws on a 40,000-word dictionary), but the spelling checker was unable to identify frequently used words, such as *penultimate* and *leaseholds*, words recognized in Houghton Mifflin's *American Heritage Dictionary* included with *WordStar 2000*.

SPELL CHECKING Spell checking in *MultiMate* is a complex process. If you use the new menus and choose Spell Check Entire Document from within the file you're writing, you'll first be greeted with a "Spell Check a Document" screen. Here you'll see the document you're working on suggested as a default filename for checking, but you're given the option of changing to another file or even another drive. Press F10 and you'll be prompted to enter the page numbers you want checked. If you hit F10 again, the spelling checker will start. A beep will indicate that it's finished. You'll see the number of misspelled or unidentified words listed at the bottom of the screen, along with a word count of the document or the portion checked.

The next step is to press any key to continue. Now you're taken into Spell Edit. Here, as in previous versions, the first character of each and every suspect word blinks continually until it receives attention. You're given the option of adding the word to a custom dictionary, bypassing the word temporarily or permanently, seeing a list of suggested correct spellings, entering the correction from the keyboard, or deleting a word from the custom dictionary. In the case of the deletion, you're not shown the contents of the dictionary; you must already know what the word is, and are re-

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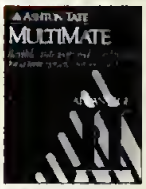


MultiMate Advantage II
Ashton-Tate
20101 Hamilton Ave.
Torrance, CA 90502-1319
(213) 329-8000
List Price: $565 ($595 for Premium Pack with 3½-inch disks, upgrades; $100 with quantity discounts.
Requires: 384K RAM, two disk drives (hard disk recommended), DOS 2.0 or later.
In Short: A major update of a former best-seller. Adds pull-down menus, auto-hyphenation, math functions, laser printer support, and other features, but it doesn't have mouse support or split-screen capability and it's still not really document-oriented. Not copy protected.

CIRCLE 638 ON READER SERVICE CARD

Word Processing Programs: Summary of Features

(Products after *MultiMate* listed in alphabetical order)

How *MultiMate* stacks up: *MultiMate Advantage II* competes with other heavy-duty products for the corporate/professional word processing market. The packages share similar features—and price tags—but as this table shows, programs such as *Microsoft Word* offer a few things that *MultiMate* doesn't, including mouse support, windowing, and true document orientation.

	MultiMate Advantage II Ashton-Tate	DisplayWrite 4 IBM Corp.	Microsoft Word 3.11 Microsoft Corp.	Samna Word IV Samna Corp.	WordPerfect 4.2 WordPerfect Corp.	WordStar 2000 Plus MicroPro Int'l Corp.
List price	$595	$495	$450	$595	$495	$495
Memory consumption	384K	310K	256K	512K	256K	256K
Maximum file length	128K	2.4 Mbytes	Unlimited	Unlimited	Unlimited	Unlimited
USER INTERFACE						
Page-oriented	●	●	○	●	○	○
Document-oriented	●*	○	●	●	●	●
Pull-down menus	●	●	○	○	○	○
Windows	None	None	8	2	2	3
FORMATTING						
Style sheets	○	●	●	○	○	●
Font menu	●	○	○	●	●	●
Preview mode	●	○	○	●	●	○
Automatic hyphenation	●	●	●	●	●	●
HARDWARE SUPPORT						
Mouse support	○	●	●	●	○	○
No. of printers	Over 400	IBM-brand printers	Over 120	50	200	Over 250
OTHER FEATURES						
Exit to DOS/ DOS functions	●	●	●	●	●	●
File import	ASCII, *1-2-3*, DCA, .DIF, *WordStar*, NAVYDIF, VCDIF, WPC	ASCII, Revisable Form Text, Final Form Text, *1-2-3*	ASCII, DCA	ASCII, DCA, .DIF	ASCII, *MultiMate* 3.22, DCA, NAVY-DIF, Final Form Text, *WordStar* 3.3	ASCII, *WordStar Professional*, *Essy Extra*, *dBASE*, DCA, 1-2-3, *Symphony*, *VP-Planner*
Draw mode	●	●	○	●	●	●
Macro capability	●	●	○	●	●	●
Math functions	6	4	5	5	4	5
Outliner	●	●	●	●	●	●
Sorting	●	○	●	●	●	●
Spelling checker (no. of words)	110,000	125,000	80,000	80,000	115,000	87,000
Thesaurus (no. of words)	40,000	None	220,000	None	200,000	220,000
Technical support	90 days	None	Free	30 days	Free/toll-free	Free
Copy protected	○	○	○	○	○	○

●—Yes ○—No *In document mode, a repagination command is still required.

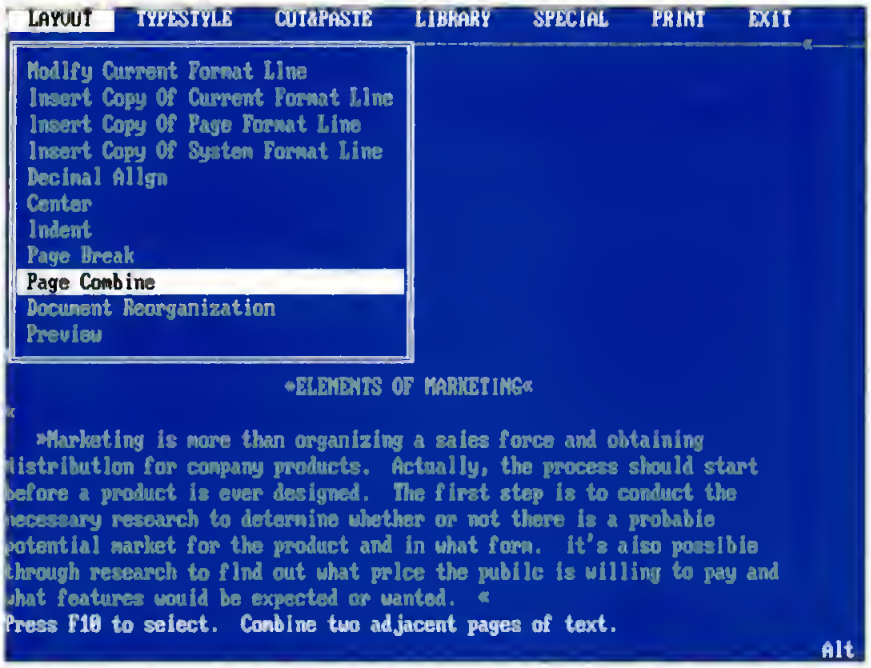
quired to type it in response to the prompt.

In fact, unlike most high-end word processors, any filename you use anywhere in *MultiMate Advantage II* must be typed in from the keyboard, even if the choices are displayed on the screen. You can't simply move the cursor to the item, highlight it, and select it by hitting Return, as you can in other programs.

If you spell-check in the manner shown on the Quick Reference Card, you won't use the pull-down menu. You'll press Ctrl-F10. However, if the cursor happens to be at the end of the file, you'll get an "Invalid Key" message. Provided the cursor is elsewhere in the file, you get the process started; but the routine won't be at all like the menu-driven version. You won't see any "Spell Check" screen. Instead, you'll get a "Check What?" prompt. Now you must highlight the area to be checked. There are several key combinations you can use for this function. For example, to highlight a word, you place the cursor anywhere within the word and press Alt-F5. Alt-F6 will highlight a line. Alt-F7 highlights a sentence. Alt-F8 gives you the entire paragraph involving the cursor. You can highlight a series of pages by continually pressing Ctrl-PgDn.

After you've highlighted the portion you want checked, you press F10 to start the spelling checker. Alt-F10 then leads you into the Spell Edit function. It might be quicker just to learn to spell.

The thesaurus offers a definition of a word before suggesting a few synonyms. If the definition shows you've got the wrong word to begin with, the program



MultiMate Advantage II *supports some limited pull-down menus, in imitation of* dBASE III Plus. *They're called up by pressing the Alt-L key combination.*

will display two or three other definitions with appropriate synonyms. An interesting feature, but the thesaurus could use some broadening—or updating. It offered only one definition of *niche*, followed by only two synonyms, *nook* and *cranny*. Neither synonym would be appropriate in connection with any business use of the word *niche*. *Word Finder*, offered with *WordStar* and *Microsoft Word*, suggests eight other synonyms.

The On-File filing module was offered free with *MultiMate Professional*, Version 3.5, then later sold as an option. It's included without additional charge again in this version and sports some enhancements. The program provides an on-screen representation of a filing card that can be flipped from "front" to "back" by pressing the F6 function key. You can file and retrieve cards by subject, keywords, date, word or character string, or color. (The color is indicated on the border outlining the card; eight color choices are available.) You can also sort up to three levels in either ascending or descending order on any field or by color. You can't retrieve cards by using logical operators such as "greater than." However, logical operators are now supported for standard *MultiMate* merging features.

■ A Preview option gives you a rough idea of how a document will print.

FILING BOXES You can type up to 597 characters on the front of a card and 600 on the back. Cards are filed in "boxes." There can be a maximum of 600 cards in a box stored on a floppy disk, fewer if the cards contain more than just names and addresses. Boxes stored on a hard disk can contain no more than 7,500 cards, regardless of the size of the disk.

You can create and save templates to simplify data entry. You can also use the On-File module to print mailing labels or address envelopes.

Although the module may be easy for experienced computer users to learn and handle, because of its limited capabilities they might be likely to consider On-File as little more than a toy.

Printer support has been extended to more than 400 printers, but laser support remains inadequate. The versatile Apple LaserWriter can be used only in Diablo daisy wheel emulation mode. Most Hewlett-Packard Laserjet cartridges are supported, plus some of the soft-font disks sold through H-P. But working with proportional fonts in this program is not easy. Like many older word processors, *MultiMate* measures its lines by the number of fixed-pitch characters on each line. This means that narrower proportional characters will occupy far less space than the program is expecting, leaving at least the right third of the line blank.

There are partial "work-arounds" for this problem, such as increasing the right margin, changing the ruler line, and changing pitch on the Document Print Options screen that flashes up just before printing. Still, proportional fonts printed with right-justified margins are likely to print out with unacceptable gaps between words. Furthermore, centering commands will give inaccurate results when these fonts are used.

Word processors such as *Microsoft Word* and *WordStar* handle proportional fonts well because they use a fixed means of line measurement such as inches.

Fonts are changed from within a document by pressing Alt-C followed by a letter for the font to be used. The letter that must be typed depends upon the Printer Action Table to be activated at printing time; these PAT files contain the drivers to support the printers and fonts selected. If you can't remember the letter that designates the font you want, you can type Alt-C followed by a question mark to get a font menu. Or you can consult the Printer Guide, one of the manuals provided.

There's a Preview option that shows the document without *MultiMate*'s formatting symbols, to give you a rough idea of how it will print.

Line and box drawing are available. The command to call up the feature is Alt-E. It can also be activated through the pull-down menu system. If your printer has the character set to support this function,

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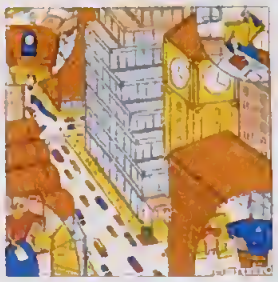

Lotus Metro

System Requirements: Lotus Metro runs on IBM® PC XT™ AT® Portable PC® COMPAQ PORTABLE® COMPAQ PLUS® COMPAQ DESKPRO® Two 5.25" double-sided disk drives (hard disk recommended for optimal performance). Minimum of 80K required for RAM resident kernel of Metro. Metro is unprotected and can be removed from memory. Lotus Metro runs with a wide variety of software programs, including 1-2-3, Symphony, Symphony Spelling Checker, Symphony Text Outliner, Lotus Report Writer™ and Signal® When you purchase Lotus Metro directly from Lotus, take your first 30 days to try it. If after 30 days, Lotus Metro does not perform as described and you've purchased it directly from Lotus, we'll gladly give you a full refund.

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*Suggested Retail Price

■ MULTIMATE ADVANTAGE II

MultiMate Advantage II's Document Reorganization menu must be used to repaginate a document whenever text is added to a completed page.

you'll find it handy and easy to use. When it's activated, a "Line Draw Mode" notice appears in the upper-right-hand corner of the screen. At the bottom of the screen are eight options that access the drawing choices illustrated. Type the number 1 and you can draw single lines using the cursor keys. Typing 2 creates a double line and typing 3 a wide, solid line. There are also options for erasing and moving the cursor to a new position without drawing.

WELCOME ADDITION Sorting is another welcome addition. You press Shift-F3 to go into column mode, then F5 for column sort. The cursor arrow keys are used to define the area to be sorted. You press F5 a second time to proceed to the Sort Options menu. Here, pressing Alt followed by a number key will let you pick options such as whether to sort on the first or last word of the line defined, in ascending or descending order, and whether the text to be rearranged consists of entire lines or only highlighted sections.

MultiMate previously offered a rudimentary outlining capability. It's still there and useful to those who need to write structured manuscripts; there's automatic section numbering to 6 levels, compared with 57 levels in *Microsoft Word*.

A directory of Key Procedures has been provided; these are user-defined macros.

It's possible now to exit temporarily to DOS. And the document summary screens can be bypassed if desired; otherwise, they show up waiting to be filled out or changed every time you enter a document.

For an extra $30 you can buy the Premium Pack, which, along with providing 3½- and 5¼-inch disks, gives you the right to use the same copy of *MultiMate* on your office machine and on your PC at home. This "personal use extension," as Ashton-Tate calls it, is an intelligent solution for people who want to take work home but are uncomfortable with copyright infringement. It's the kind of policy other publishers should adopt.

On the whole, this release should get good marks from current *MultiMate* users. However, those contemplating an initial purchase of a new, full-featured word processor have more powerful programs available for consideration. PC

Marvin Bryan is a Michigan-based freelance writer.

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CIRCLE 255 ON READER SERVICE CARD

Corporate Individual Software Strategies for File Backup

Can there be any doubt about how top management would react to losing the spreadsheet that contains next year's budget projections, the Gantt chart of production schedules for four Midwest manufacturing sites, or the lengthy licensing agreement that was typed last week and is awaiting the review of the company's chief counsel? Increasingly, businesses are recognizing the extraordinary investment they have in their electronic files—files that hold budgets, projections, schedules; files that contain the company's past, present, and future. And increasingly, they are investing in the protection of those valuable files by purchasing hardware and software to assist in backing them up.

Backup. It's something we all know we should do all of the time. How many of us do it? Take a poll of your coworkers and ask when they last backed up the files on their hard disk. Then ask how many have ever backed up the files on their hard disk. An increasing number of products are giving us fewer and fewer excuses for not performing this essential task.

You can back up your data to disks or to tape drives. Tape drive backups are the fastest, but they are the most expensive. Tape drives can cost as little as Micro Design International's $595 MDI External MT-40P/AT or as much as Advanced Digital Information Corp.'s $1,390 ADIC TD-440. (See "Backup Choices from Tapes to Disks to WORMs," *PC Magazine*, Volume 6 Number 12.)

Floppy disk backup is the least expen-

A wave of new products is making it easier and faster to back up your files to floppy disks.

sive and most flexible of the two techniques. In this review we examine 17 software products that range in price from $39.95 to $179 and enhance the speed and flexibility of traditional DOS backups to floppy disks. Although tape drives are generally considered the safest and most convenient medium for backup, they can be awkward. Software backup programs provide flexibility you cannot get with many tape programs—flexibility that lets you selectively back up and restore files and directories from and to virtually any type of medium.

■ The advantages of software backup are significant. The products are inexpensive, and some allow you to back up to any DOS device.

In this review we looked at *Back-It*, *BackTrack*, *Backup Master*, *Corefast*, *DataCare*, *DSBackup Plus*, *Fastback*, *Fullback*, *Intelligent Backup*, *Jet*, *KeepTrack Plus*, *PC FullBak*, *Pdisk*, *Quiksave*, *Sav-Key*, *Sy-Stor*, and *TakeTwo*. Many of these programs interface with any type of disk: floppy, hard, removable, and virtual—even to a LAN server or to a tape unit that has been initialized as a DOS device. These programs are also more convenient than their tape counterparts if you have to transfer a large data file from an XT or AT to a PS/2.

But there are some disadvantages to these products. Floppy disks are more easily lost, damaged, or otherwise rendered unusable than tapes and removable hard disk cartridges. Vendors of some of these products assert their program takes only a few minutes to back up 10 megabytes of data to floppy disks. Even if true, the claim doesn't consider the tennis elbow that results from the fast disk swapping the speed necessitates.

The advantages of software backup, nevertheless, are significant. First and foremost, the products are inexpensive. Second, some allow you to back up to any DOS device, which means a network supervisor can have each node backed up directly onto the LAN server and from there to a common tape system. This not only saves time and expense, but it also means all of the backed up data is centrally located. Finally, floppy backup is more suitable than tape backup if you need only to transfer one or two large data files to 3½-inch media.

Many of the programs we reviewed have a high-speed mode that relies on a proprietary, non-DOS formatting scheme. While such modes speed the backup process greatly, they also present certain limitations and problems. Because such programs reformat the target medium, they are incapable of performing a backup to a DOS device other than a floppy disk drive. (If a high-speed program allows you to back up to a network server, you will definitely have problems later.) Finally, high-speed programs should certify the target drives. While most such programs recommend a speed setting, few check the drive for alignment. As a result, when the program writes to a bad drive, it will either abort in midstream if the verify option has been set or it will be unable to restore the data later.

For this reason we recommend that you use the normal-speed mode, if available—especially when the data being backed up is irreplaceable. Speed is a nice plus to the backup process, but more important is the integrity of your data. Ultimately, you want the process to be conducted reliably and with ease. If a program takes 2 minutes to back up a file but cannot restore it properly, the program will be useless. If the program is confusing or difficult to use, it likely will gather cobwebs on the software shelf before anyone uses it to gather a directory listing.

Backup software provides you with on-screen information before you activate the backup process. You should expect a program to spell out the steps needed to complete the task—global defaults, such as drive designations, and any applicable options. Once you select an operation, you'll probably want the program to estimate the amount of time the operation will take and the number of disks that will be needed. You might also want the program to alert you to how far along you are in the process.

For options, nothing beats the ability to include and exclude files. With exclusion, you can omit your program, system, and hidden files from the backup. With inclusion, you can force your transaction files to be processed. Other useful features include protecting backed up files from accidental erasure by setting the read-only attribute, requiring confirmation before overwriting files, and providing sequenced labels for the disks.

Back-It

If you're new to the fine art of backing up, Gazelle Systems' *Back-It* may catch your eye. This $99.95 menu-driven program offers tandem processing to both the A: and B: drives in either of two speed modes. It also lets you design and save customized configurations, format or automatically overwrite the target media, temporarily exit to DOS, and generate a report of the backup. Version 2.0, which we tested, had a few vexing quirks. Version 3.0, which was not available at the time this review was written, should be available by now along with its improvements.

To start with, *Back-It* fills your screen to the point where you may begin looking away to rest your eyes. The top of the screen features a *1-2-3*–like menu bar. That is followed by drive information.

PC MAGAZINE FACT FILE

***Back-It*, Version 2.0**
Gazelle Systems
42 N. University Ave., #10
Provo, UT 84601
(801) 377-1288
List Price: $99.95; Version 3.0, $129.95.
Requires: 256K RAM, hard disk drive, DOS 2.0 or later.
In Short: A menu-driven backup/restore program, *Back-It* is flexible but has a busy screen and a rigid file-restoration scheme. Not copy protected.

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To find out where to buy Cipher's PC60Bi and PC125Fi tape systems, call 1-800-4-CIPHER.

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CIRCLE 232 ON READER SERVICE CARD

Backup Software: Summary of Features

(Products listed in ascending price order)

	DOS Microsoft Corp.	BackTrack Tallgrass Technologies Corp.	PC FailSafe Westlake Data Corp.	Jet Tall Tree Systems Inc.	KeepTrack Plus The Finot Group	DSBackup Plus Design Software	Backup Master Intersecting Concepts Inc.	Sav-Key Business-Pro	Quiksave Micro Interfaces Corp.
List price	N/A	$39.95	$59.95	$60.00	$79.00	$79.95	$89.95	$89.95	$99.00
FORMAT TYPES									
Non-DOS	○	○	●	○	○	●	●	○	●
DOS	●	●	○	●	●	●	●	●	○
TARGET DRIVE SUPPORT									
360K-byte	●	●	●	●	●	●	●	●	●
1.2-Mbyte	●	●	●	●	●	○	●	●	●
1.44-Mbyte	●	●	●	○	●	●	●	●	●
Hard disk	●	●	○	●	●	●	●	●	○
LAN server	●	○	○	○	●	●	●	●	○
Other DOS device	●	●	○	●	●	●	●	●	○
BACKUP FEATURES									
Creates readable backup	●	●	○	○	●	○	○	●	○
Saves include files	○	●	○	●	●	●	●	○	●
Saves exclude files	○	●	○	●	●	●	●	○	●
Saves command files	○	●	○	●	○	●	●	○	●
Prevents accidental erasure	○	○	●	○	○	○	●	○	●
Sets archive bit	●	●	●	○	●	●	●	●	●
Verifies backup	●	●	●	●	●	●	●	●	●
Estimates no. of disks	○	●	○	○	●	●	●	○	○
Creates catalog on target	●	●	○	○	●	●	●	○	●
Displays disk number	●	●	●	○	●	●	●	○	●
RESTORE FEATURES									
Verifies restore	●	●	●	○	●	●	●	●	●
Restores to different directory	●	●	○	●	○	●	●	○	●
Restores to different disk	●	●	●	●	●	●	●	●	●
Creates restore report	○	○	●	○	○	○	○	○	●
Searches through catalog	○	●	●	○	○	○	○	●	●
TYPES OF BACKUP									
Full backup	●	●	●	○	●	●	●	●	●
Backup by archive	●	●	●	●	●	●	●	●	●
Backup by directory	●	●	●	●	●	●	●	●	●
Backup by date	●	●	●	●	●	●	●	●	●
Backup by date range	○	●	○	●	○	○	●	○	○
Backup by wildcard	●	●	●	●	●	●	●	○	●
Backup by filename	●	●	●	●	●	●	●	●	●
MISCELLANEOUS									
Supports batch files	●	○	●	●	●	●	●	○	●
Includes labels	○	○	○	○	○	○	●	●	○
DOS shell	○	●	○	○	●	○	●	○	○
Other utilities	○	○	○	●	●	○	○	○	○

PC—Indicates Editors Choice ●—Yes ○—No N/A—Not applicable; price varies depending on method of purchase.

	Back-It Gazelle Systems	DataCare Ellicott Software	Fullback ALPS	Pdisk Phoenix Technologies Ltd.	Corefast Core International Inc.	Intelligent Backup Sterling Software	Sy-Stor Sytron Corp.	TakeTwo United Software Security Inc.	Fastback Fifth Generation Systems Inc.
List price	$99.95	$129.00	$129.00	$145.00	$149.00	$149.95	$149.95	$165.00	$179.00
FORMAT TYPES									
Non-DOS	○	○	○	●	●	○	●	○	●
DOS	●	●	●	●	●	●	●	●	○
TARGET DRIVE SUPPORT									
360K-byte	●	●	●	●	●	●	●	●	●
1.2-Mbyte	●	○	●	●	●	●	●	●	●
1.44-Mbyte	○	○	○	○	○	●	●	●	○
Hard disk	●	○	●	●	●	●	●	●	○
LAN server	●	○	●	●	●	●	●	●	○
Other DOS device	●	○	●	●	●	●	●	●	○
BACKUP FEATURES									
Creates readable backup	●	●	●	●	○	○	○	●	○
Saves include files	●	○	●	●	●	●	●	●	○
Saves exclude files	●	○	●	●	●	●	●	●	○
Saves command files	●	○	●	●	●	●	●	○	○
Prevents accidental erasure	●	○	○	○	○	●	●	●	●
Sets archive bit	●	●	●	●	●	●	●	●	●
Verifies backup	●	●	●	●	●	●	●	●	●
Estimates no. of disks	●	●	●	●	●	●	●	●	●
Creates catalog on target	○	●	●	●	●	●	●	●	●
Displays disk number	●	●	●	●	○	●	●	●	●
RESTORE FEATURES									
Verifies restore	○	●	●	○	●	●	●	●	●
Restores to different directory	●	●	●	●	●	●	●	●	●
Restores to different disk	●	●	●	●	●	●	●	●	●
Creates restore report	●	○	○	○	●	○	●	○	○
Searches through catalog	○	●	○	●	●	●	●	●	●
TYPES OF BACKUP									
Full backup	●	●	●	●	●	●	●	●	●
Backup by archive	●	●	●	●	●	●	●	●	●
Backup by directory	●	●	●	●	●	●	●	●	●
Backup by date	●	●	●	○	●	●	●	○	○
Backup by date range	●	○	○	○	○	○	●	○	●
Backup by wildcard	●	●	●	●	●	●	●	●	●
Backup by filename	●	●	●	●	●	●	●	●	○
MISCELLANEOUS									
Supports batch files	●	●	●	●	●	●	●	●	●
Includes labels	○	○	○	○	○	●	○	●	○
DOS shell	●	○	○	○	○	●	○	○	○
Other utilities	○	●	○	●	●	●	●	●	○

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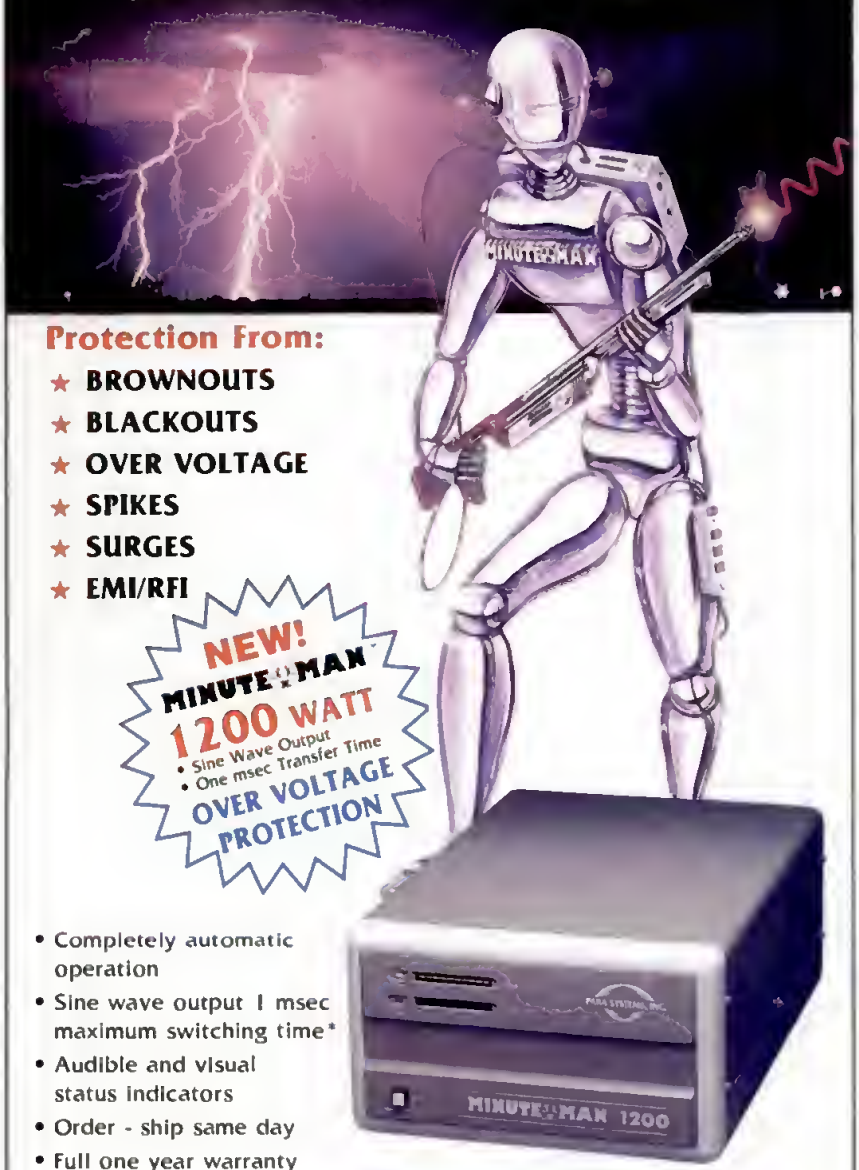

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CIRCLE 500 ON READER SERVICE CARD

■ BACKUP SOFTWARE

Filling most of the rest of the screen is status data, grouped into four categories: function key commands, file selection parameters, other backup parameters, and backup statistics, such as percentage of operation completed and number of files remaining. The bottom quarter of the screen lists filenames copied as the program progresses; you can also toggle on help messages. This information is very nice, but is it really necessary to see it all the time?

Otherwise, *Back-It* is reasonably accommodating. In addition to full backups, it gives you four ways to customize partial backups. First, you can designate up to ten files each for inclusion and exclusion, and wildcards are supported in the filenames. Also, *Back-It* lets you select a directory by tagging it in the program's graphic tree display. You can back up by archive bit, too—and after the backup, the program can reset the bit so that the files will be reprocessed with the next backup. Finally, you can select files by date. *Back-It* also provides three levels of verification: none, DOS, and proprietary. And before performing a backup, the program will estimate the minimum number of disks necessary for the procedure.

Back-It lets you generate a report of the backup, but not a terribly informative one: it amounts to only a directory listing that notes which files have been backed up to which disks. And because each report is overwritten on the next backup, the only way to maintain a backup history is to name each report differently and merge or copy them to different directories. In any event, you're the one doing the work.

Version 2.0 lets you restore to another directory or drive but retains the original directory structure. For example, if you want to restore files from a directory called DOC to a new one called OLD_DOC, *Back-It* will create the directory and place the files in a subdirectory called \OLD_DOC\DOC. It's a minor point, but it does mean you can't use this program to defragment your drive selectively.

Back-It is a respectable, easy-to-use program that novices will find extremely useful. Power users, though, may not like the lack of batch support, the rigid restore design, and the overwhelming screen in Version 2.0. We expect changes in the new version.

BackTrack

Tallgrass Technologies Corp.'s *BackTrack*, which lists for $39.95, is perhaps the most unique product in this roundup. It alone has the ability to process files in the background while you are computing in the foreground. It accomplishes this by stealing system resources during idle moments in your work. It may not be true multitasking, but it is the closest PCs will ever manage under DOS.

Like many other programs, *BackTrack* offers full and modified backup operations. Unlike some, it provides flexibility in the form of file inclusion and exclusion, date ranges, and target media. Since *BackTrack* can back up to DOS-formatted devices, the destination can be a floppy disk drive, another hard drive, or a removable hard drive. It also supports Tallgrass's PC/T tape subsystem and mainframe virtual drives.

Installing *BackTrack* entails running a setup program. This creates the necessary subdirectory, copies the program files into it (including the hidden ones), and then alters your AUTOEXEC.BAT and CONFIG.SYS files. Do not be surprised to see buffers set at 88 if you've been running the program in the foreground at high speed. Once installed, processing is virtually automatic.

When using *BackTrack* in the background mode with a floppy drive as the target medium, you need to configure it as either dedicated or shared. Dedicating the drive implies a steady, uninterrupted stream of data to the disk. Sharing the destination drive means you must temporarily suspend *BackTrack* when you need to insert a new program, such as Lotus's *1-2-3*. (Of course, you don't have to play disk swap if you don't use copy-protected programs.) In either case, *BackTrack* prompts you for a new disk when the target is full.

BackTrack does not assume you want to be left in the dark. Whenever it has something to report, it informs you by popping up a status window near the lower right-hand corner of the screen. Once it takes the initiative and begins accessing the target drive, *BackTrack* puts a smiling face in the upper right-hand corner of the screen.

As convenient as background processing is for dual hard or floppy drive–based systems, its usefulness on single-drive systems depends upon the amount of usage your single drive usually gets. If you are constantly inserting application or data disks into the drive, the time you save with background processing can be lost by suspending and restarting the program.

You can also set the program up so that the backup almost occurs in the foreground. Unfortunately, when you attempt to run a program that occupies a lot of the system's resources, it and *BackTrack* begin fighting for the processor's time to the point where keystrokes are ignored and other processing is almost impossible.

BackTrack is worthy of your attention. Of course, if you plan to purchase a Tallgrass tape subsystem, *BackTrack* is a must. It is also highly recommended if your data, situation, or temperament is such that you require constant backups.

PC MAGAZINE FACT FILE

BackTrack
Tallgrass Technologies Corp.
11100 W. 82nd St.
Overland Park, KS
66214
(800) 228-DISK
(913) 492-6002

List Price: $39.95
Requires: 256K RAM, hard disk drive, DOS 2.0 and later.
In Short: A backup/restore program that operates in the foreground and background and interfaces with a variety of media, including Tallgrass's tape drive systems. Not copy protected.

CIRCLE 634 ON READER SERVICE CARD

Backup Master

Intersecting Concepts' *Backup Master* is a full-featured $89.95 multispeed backup and restore program. In addition to offering total and incremental backups, it also provides capabilities for including and excluding specified files, generating a log, and backing up to a variety of media, including networks and Bernoulli disks.

Backup Master's easily followed menu interface uses function key selection, screen swapping, and pop-up windows. It boasts a graphic tree of the *X-Tree*-type in which the disk structure and filenames are relegated to separate windows. It also offers a DOS shell so that you can temporarily exit the backup or restore process, check disks or files, and run small programs.

Like many other programs, *Backup Master*'s installation offers to alter your AUTOEXEC.BAT and CONFIG.SYS files. Unlike some, it performs its task properly, appending its subdirectory to the existing path command and replacing the original buffer statement with one you select from a menu. It also renames your original files so that all is not lost if some unforeseen incompatibility does happen to make things go awry. This concern for the user is reflected even in the display of statistics.

While *Backup Master* provides estimates of such things as the number of files and how many bytes, disks, and minutes will be required to perform a backup, it does not (as many other speed-oriented programs do) display the time you spend swapping disks. Instead it creates a percentage completion display.

You can select files for inclusion by their date stamp and archive flag. You can designate specific files or directories by include/exclude directives. Because *Backup Master* lets you choose the target device, you can use it to process files to anything from a 360K-byte floppy disk to a tape drive configured as a hard disk. In addition

PC MAGAZINE FACT FILE

Backup Master
Intersecting Concepts Inc.
80 Long Ct., #1A
Thousand Oaks, CA
91360
(800) 422-8018
(800) 373-3900 (in Calif.)

List Price: $89.95
Requires: 384K RAM, hard disk drive, DOS 2.1 or later.
In Short: An extremely friendly, flexible, and powerful multispeed backup and restore program that can interface to a variety of media. Not copy protected.

CIRCLE 633 ON READER SERVICE CARD

to the double- and high-density floppy disks, *Backup Master* supports the new PS/2 media. The documentation states that *Backup Master* was tested in configurations that included Novell and Corvus networks, IRMA boards, and Bernoulli disks.

The restore procedure is feature-packed. It allows you to restore all or some files, restore to different drives and different directories, and even create directories as they are needed during the restore procedure. There are even restore options to force the setting, resetting, or ignoring of the file's archive flag.

Backup Master's error correction scheme is among the best we've seen. If the program detects a bad disk during a backup, it prompts for a new disk and resumes the backup at the beginning of the new disk. If it encounters a bad file that it cannot restore, it attempts to correct the problem by recreating the bad sectors. Failing that, it displays an appropriate message and restores the remaining files on the disk—it does not drop out of the restore operation and fail to process the rest of the files as other programs do. According to the documentation, the error correction algorithm tolerates up to 20 percent of the disk surface being damaged.

■ Like other high-speed backup programs, *Backup Master* uses its own formatting algorithm.

Although the documentation recommends setting turbo systems to the slowest clock speed setting, we had no trouble using the high-speed DMA selection while running on a Maxum AT in its 8-MHz, 0-wait-state mode. However, it is wise to test the waters first.

Like many of the other high-speed backup programs, *Backup Master* uses its own formatting algorithm. While this ensures that the program will be able to recognize its own disks, it also means that the backup is at the mercy of the program and the vendor's upgrade. All in all, though, this program provides a lot of flexibility and power.

Corefast

Corefast, from Core International, lists at $149 and is more than simply a high-speed backup/restore product: it offers image processing and file-by-file arrangement, allows exit codes for batch file operation, and features a set of enhanced DOS disk utilities. That Core International would develop this kind of software is not surprising; the company is also known for its high-speed, high-capacity hard disks. Unlike Core's other products, however, Corefast is rather temperamental.

Corefast's main interface is a straightforward menu with seven options, accessible with function keys: Help, Backup, Restore, Display Backup Directory, Diskette Utilities, File Maintenance Routines, and Exit to DOS. Selecting Backup or Restore brings up a parameters screen; applicable options, such as inclusion of subdirectories and modified files, are toggled with function keys. The package also provides a few miscellaneous utilities: WAIT, for specifying a length of time; CFDIR, a directory-listing program; and CFUTIL, a proprietary format program. These can be accessed directly from the DOS command line or in a batch file. The programs will display the proper syntax.

Corefast offers two types of backup/restore operations: image and file-by-file. You can execute the file-by-file option either ad hoc or through a script. Scripts enhance batch file operations by letting you create a catalog of files and subdirectories to be processed and include contingencies for DOS error messages. *Corefast* checks returned error codes to verify aspects of the environment such as the version of DOS, the command line parameters, the available buffer memory, the file specifications, and the disk format.

Corefast is flexible and easy to use. To restore a file or files, for instance, you simply insert the first volume of the backup, call up the program, and tag the files you want. Unlike other programs, though, *Corefast* doesn't beep to let you know when to change disks.

One nice feature of *Corefast* is a file management module that lets you tag, copy, move, and delete files and make and remove directories, among other functions. The module divides the screen in two, with commands in the right-hand window and directories and files in the left-hand one. Having utilities that extend DOS's commands is a bonus. The Core program's view file feature, for example, will automatically display text as text and program files as hex characters, but it will not let you page back. Furthermore, the *Corefast* utilities display files and directories as text rather than as a visual tree, so you can't see a subdirectory's files and the disk structure simultaneously.

Corefast will work on your oldest equipment and your newest. In addition to supporting XTs, ATs, and a number of networks, the package operates in both its high-speed and normal-speed modes with the IBM Personal System/2 Model 30 and in its normal-speed mode with the PS/2 Models 50 and 60.

As impressive as *Corefast* is, it has its problems. When used in its high-speed file-by-file backup mode, it would occasionally find floppy disks not to its liking, reporting from 11 to 15 bad sectors per disk. (It's worth nothing that when those same disks were tested with *Quicksave*, that program simply formatted the sectors *Corefast* had deemed bad and continued with the backup and restore.)

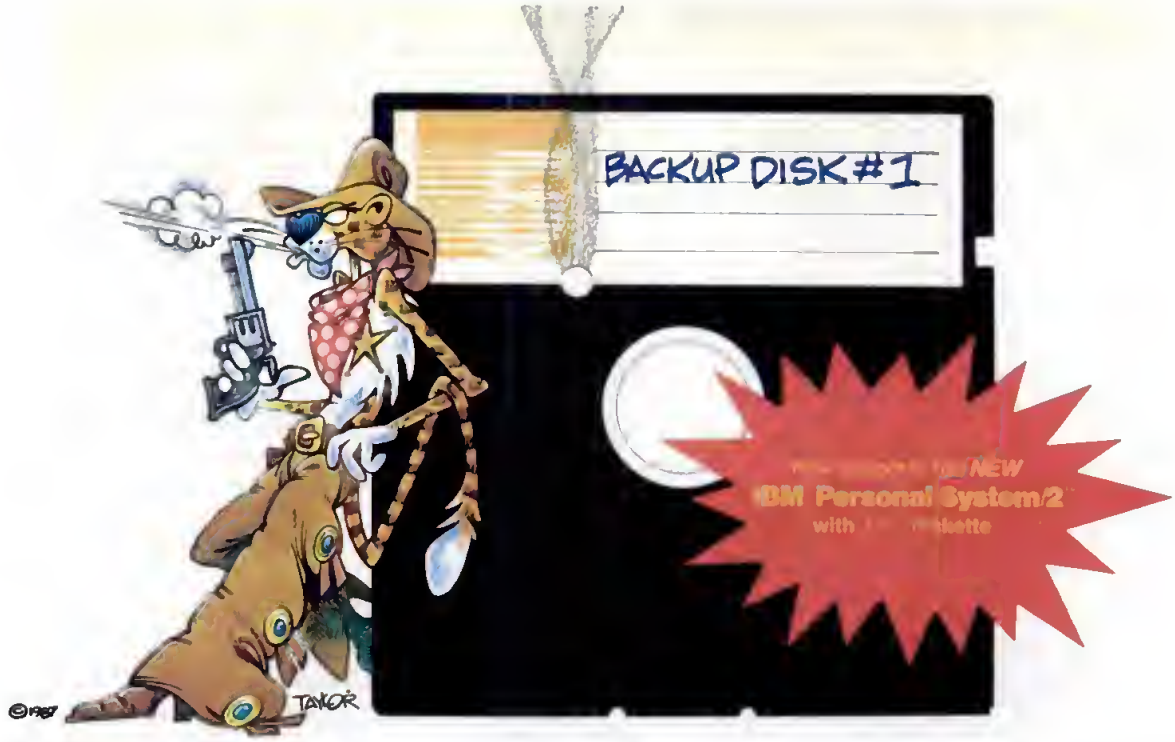
In fairness, high-speed backups and restorations to floppy disks are inherently chancy; they don't necessarily reflect a product's performance in a normal-speed DOS mode. At its slower setting, *Corefast*

PC MAGAZINE FACT FILE

Corefast, Version 1.2
Core International Inc.
7171 N. Federal Hwy.
Boca Raton, FL 33431
List Price: $149
Requires: 256K RAM, hard disk drive, DOS 2.0 or later.

In Short: Includes useful utilities and allows backups and restorations at two speeds, although the high-speed mode is not consistently reliable. Not copy protected.

CIRCLE 632 ON READER SERVICE CARD



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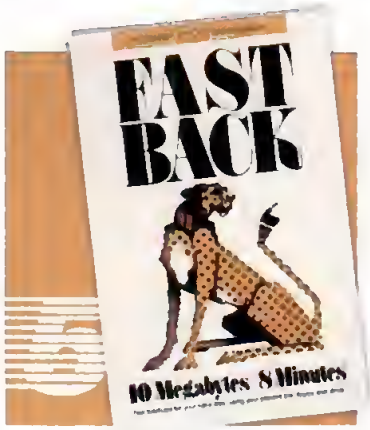

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CIRCLE 286 ON READER SERVICE CARD

is a reliable and helpful utility for use with a network, a tape backup system, or floppy disks. Using it in the high-speed mode, however, is a lot like walking a tightrope—without a net.

DataCare

Ellicott Software's *DataCare* is a flexible $129 menu- and command-driven backup program with a twist: it uses the DOS RESTORE program for its restorations. It differs from some "user-friendly" programs in that you really can run *DataCare* without having read the manual. These attributes, coupled with the program's lack of the detailed report features, make *DataCare* best suited for individual users.

DataCare's smooth, simple menu interface doesn't fill your screen with unnecessary information and excessive commands. It merely displays a vertical form with the necessary parameters already filled in, giving you the opportunity to change the defaults. Some fields, such as filenames, require user input; others, such as switches for subdirectory inclusion, need only be toggled. This concise, intuitive interface is a pleasure to work with.

The command line interface, which supports batch files, lets you include subdirectories, append files to a previously backed up disk, print the index, select files by date and archive bit setting, and suppress the beep. Since *DataCare* uses the same format as DOS BACKUP and includes no restoration program, you must use DOS to restore files. Essentially, this means you'll have to learn the DOS syntax or keep the manual handy. While this may seem troublesome, remember that it also means your archived data will always be 100 percent DOS compatible—something few other vendors, can really claim.

DataCare also includes three utilities that provide enhanced DOS-like commands. The first utility—a replacement for the DOS DIR command—lists hidden and system files and file attributes, among oth-

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Format Converter	1096	X	X	X	X	$ 99

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CIRCLE 106 ON READER SERVICE CARD

PC MAGAZINE FACT FILE

DataCare
Ellicott Software
3777 Plum Hill Ct.
Ellicott City, MD 21043
(301) 465-2690
List Price: $129
Requires: 128K RAM, hard disk drive, DOS 2.0 or later.
In Short: A reliable backup program that includes three useful utilities and restores through DOS but does not support 1.2-Mbyte drives. Not copy protected.

CIRCLE **631** ON READER SERVICE CARD

er things. The second utility lets you compare two files, including system and hidden files and those in different subdirectories. The final tool corrects and replaces the DOS RENAME command. This utility not only renames the file but also resets the archive bit so that the file is processed on the next operation. You can use it to rename subdirectories, too, and to move files or entire subtrees.

One of the better and friendlier programs on the market, *DataCare* unfortunately hasn't grown much. A particular flaw is its lack of support for the AT's 1.2-megabyte drive. That support is forthcoming, Ellicott Software tells us, but for now users with high-density floppy drives should probably avoid this package. If you have a 360K-byte drive and prefer complete DOS compatibility, however, *DataCare* will give you an easy-to-use backup interface and some very handy utilities.

DSBackup Plus

Design Software's $79.95 *DSBackup Plus* includes the high-speed backup operation, SPEEDBAK, and also comes with a normal-speed program, DSBACKUP, as well as options for compressing data, backing up to multiple volumes, and accessing logical DOS devices other than the A: drive. Though a few characteristics make it less than perfect, *DSBackup Plus* is an extremely flexible package.

The normal-speed program, DSBACKUP, works with any logical device, including another hard disk, a tape cartridge, and virtual volumes on a LAN or mainframe. SPEEDBAK lays out a non-DOS format and can be used only with floppy drives. Beyond that, however, the two programs share a number of virtues. Both can be executed either through menus or through the DOS command line. Both support wildcards in file specification, let you include and exclude specific files, and let you selectively restore all or

PC MAGAZINE FACT FILE

DSBackup Plus
Design Software
1275 W Roosevelt Rd.
West Chicago, IL 60185
(800) 231-3088
(312) 231-2225
List Price: $79.95
Requires: 256K RAM, hard disk drive, DOS 2.0 or later.
In Short: A backup/restore program that offers both normal and high-speed operation and permits transfers to logical DOS devices other than floppy drives. Not copy protected.

CIRCLE 630 ON READER SERVICE CARD

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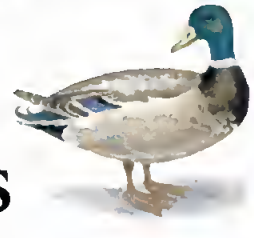
It's  !

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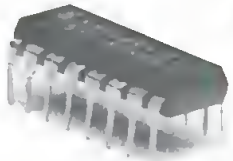

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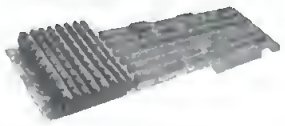

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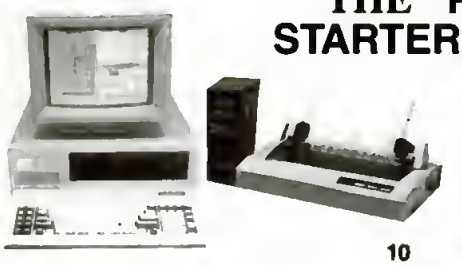

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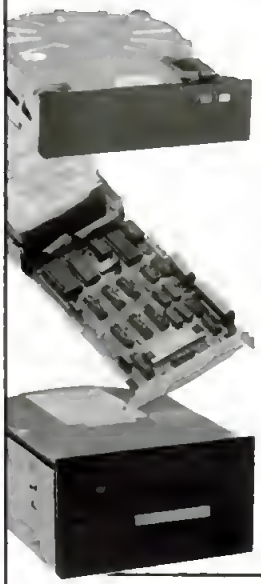

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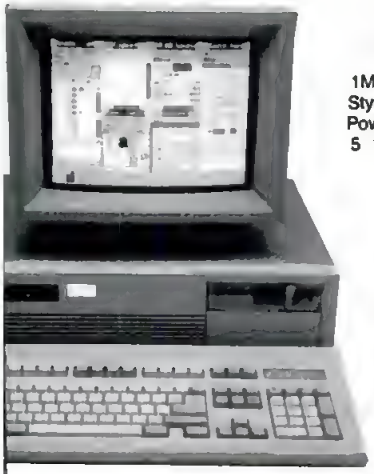

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part of the backed-up files. You can also save a particular setup for execution later, and you can specify up to four volumes as target drives. The package will back up files by date, archive bit, and subdirectory. It can limit the backup to changed files, exclude hidden files, prompt for subdirectory selection, verify disk access operations, and leave archive bits unchanged. *DSBackup Plus* also creates an optional report and estimates the number of disks required.

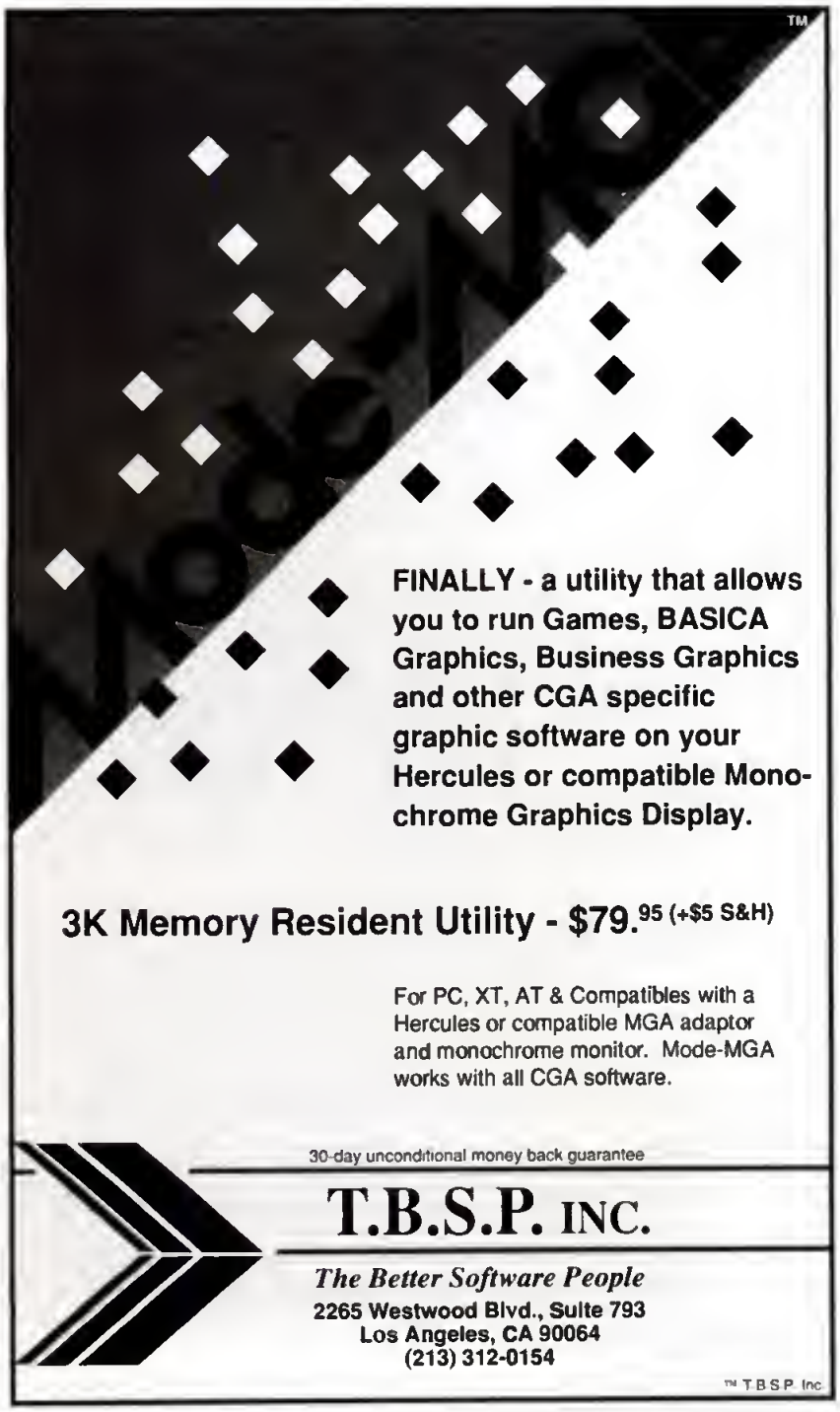
The menu interface is similar for both backup programs: the top half of the screen is relegated to status and command information, and the bottom half displays files and error messages. While many of the options and commands are toggled, a few, such as file specifications, require user input. One complaint about the program concerns its confusing use of the terms "destination" and "source" in the menu, but a new version (still in beta-test form as of this writing) remedies that problem by using different terminology.

If storage space is important to you, the program has a squeeze option that eliminates unused sector space and concatenates all of the files into a single large one. This option slows things down a bit, however, and increases the memory required, so you could get an out-of-memory message after you toggle the option.

■ If storage space is important to you, *DSBackup Plus* has a squeeze option.

Before backing up a drive, *DSBackup Plus* maps and indexes the disk's structure and then uses that map for the restoration. The program doesn't keep track of which files are being restored but processes the entire mapped path, whether files are present or not. Thus, if you restore files to a different drive, *DSBackup Plus* will recreate the original drive's structure. The only way to avoid this is by setting the option that prompts you for subdirectory creation. This design is ideal if you want to fashion a duplicate image of the hard disk on another drive, but it's tedious if you're simply restoring selective directories.

DSBackup Plus will create a report, albeit a rather disappointing one: it simply lists the files and directories being processed, not the type of operation performed. Also, the program uses a write-length check to verify the integrity of a



write procedure. This means that if you back up the optional report, you'll get an error message, because that file will expand as it is checked.

Despite these minor annoyances, *DSBackup Plus* is a valid and inexpensive alternative to DOS BACKUP—flexible, powerful, and easy to use.

Fastback

Before Fifth Generation Systems' *Fastback* came along, backing up to floppies was pie in the sky. Yes, there was DOS BACKUP, but that took forever, offered no help other than the manual, and was less than reliable. *Fastback*, which lists at $179, changed all of that: it was the first program to back up an XT in approximately 10 minutes. Though Version 5.14 has cut that by about half, *Fastback* no longer beats every other program around.

One way *Fastback* achieves its speed is by keeping the floppy drive spinning constantly. The program prompts you to insert and remove disks and then begins writing to disk as soon as the drive door is closed. Because the drive doesn't stop and restart with each disk swap, there is no time loss, except for that attributable to the user. In fact, *Fastback* maintains two timers on-screen—one for clocking the entire process and another for timing you as you swap disks. Also on-screen during both backup and restore operations are the active drives, the current disk number, the available options, and the files as they are processed. The program has options for subdirectories, for including only modified files, and for verifying after write. Like other backup programs, *Fastback* takes advantage of a second disk drive.

The program's focus on speed has its price, however. For one thing, *Fastback* isn't terribly flexible. You can perform operations on the command line or in a batch file, but you can't back up to the device of your choice—unless that device happens to be a floppy drive. Also, since *Fastback* bypasses DOS and manages the drives on its own, it must first test and then pass or fail your system's drives and DMA chip. If the latter can't transfer data at high speeds (and some earlier XTs had problems), *Fastback* flunks it; your drives won't pass muster, either, if they don't maintain a steady rotation of 300 RPM. Either failure causes *Fastback* to install itself in a slower mode. Repairing or replacing the defective parts and reinstalling the program can bring it up to the higher speed.

As conscientious as this program is, it's not foolproof. *Fastback* uses the drive to check the DMA chip, so if the drive fails during the DMA test, *Fastback* assumes it's the chip's fault. More important, it doesn't check the drive's alignment—and a misaligned drive that passes muster could cause problems during a restore procedure.

Fastback creates and stores a catalog of the backup. If during a restore the program encounters an error, it attempts to reconstruct the data. If it fails, it erases the catalog and drops you into DOS.

A program like *Fastback* probably doesn't offer enough flexibility for serious archiving. But if you like living in the fast lane and believe you can overcome the inherent deficiencies of a high-speed program, it's worth a look.

PC MAGAZINE FACT FILE

***Fastback*, Version 5.14**
Fifth Generation Systems Inc
2691 Richter Ave., #107
Irvine, CA 92714
(800) 225-2775
List Price: $179
Requires: 128K RAM, hard disk drive, DOS 2.0 or later.
In Short: The original high-speed backup/restore program is no longer the fastest on the block. Not copy protected.

CIRCLE 629 ON READER SERVICE CARD

Fullback

ALPS packages eight command line utilities as its $129 backup software program, *Fullback*. The program includes three backup programs and five utilities. The backup programs are *Fullback*, which backs up to a single target medium; Halfback which backs up to floppy disks; and Bigback, which splits large files across more than one disk. Because the utilities are DOS compatible, you can read text files, execute program files, and use any legitimate DOS device as a target.

You use *Fullback* to process files to a single medium—floppy or hard drive. That implies there will be situations when the number of bytes on the source exceeds the available bytes on the target. For that situation, ALPS supplies three utilities—DIRimage, CTLback, and CREATdir—that ease Fullback's operation and prevent mishaps or futile processing. Because *Fullback* acts as a transfer utility, restoring files is a matter of reversing the drive letters on the command line. For example, *Fullback* C: A: performs a backup, while *Fullback* A: C: restores the files. Switches allow you to back up by date, set the archive bit, leave it unchanged, and turn it off.

DIRimage is used to create a subset of your source drive's directory structure on the target. When evoked, it displays the structure in alphabetical order along with the number of bytes in each directory. You then select the directories to be processed, and DIRimage creates them on the target disk. If you select, for example, a third-level subdirectory, its parent directories are automatically selected, thus preserving the original structure. This does not overwrite existing directories on the target, and you can use the command to append to an existing backup. When you transfer the root directory, it is notated by an underscore and the word "root."

CTLback gives *Fullback* the ability to include and exclude specified files and directories. In addition to providing the ca-

PC MAGAZINE FACT FILE

***Fullback*, Version 3.0**
ALPS
1502 County Rd., #25
Woodland Park, CO 80863
List Price: $129
Requires: 256K RAM, hard disk drive, DOS 2.0 or later.
In Short: A set of eight command-driven utilities that provide flexible options and low memory and storage overhead. Not copy protected.

CIRCLE 628 ON READER SERVICE CARD

pability to customize backups, it allows you to exclude files that should be processed by Bigback as well as subdirectories that would not fit on the target. You can specify files by name, wildcard, first character range, and conditional criteria.

You use CREATdir when the target is as large or larger than the source. The command has but one syntax—CREATDIR *source: target:*—and can be used to back up an entire drive to another hard disk.

Halfback provides the ability to back up a hard disk to floppy disks. While it does not process large files (only Bigback does), it will maintain the directory structure and not split files across disks. This enables you to use DOS commands with the files. You restore files with DOS's COPY command. Halfback will also tell you how many disks are needed, prompt you for the next disk, format when necessary, and create an optional log that lists which files are on which disks.

Bigback splits large files across floppy disks. Its syntax and use are simple, and restores are accomplished with a switch setting. The *Fullback* package also includes two utilities, Makemod and Moddirs, for modifying the archive bit and checking the existence of modified files on the drive, respectively.

What *Fullback* lacks in speed and interface, the individual programs make up for in usefulness, flexibility, and power. If you don't mind the DOS prompt and you do want a program more flexible than DOS's own BACKUP, then ALPS's *Fullback* is for you.

Intelligent Backup

Intelligent Backup, a $149.95 program from Sterling Software, interfaces with numerous media, provides a full-screen text editor, has the ability to maintain up to eight different indexes for operations, and includes one of the most elegant and friendly installation programs on the market. Still, its backup scheme can be rigid.

The installation program is relatively hassle-free. It optionally alters your AUTOEXEC.BAT and CONFIG.SYS files. If you agree to the alterations in your batch file, *Intelligent Backup* displays the contents of your batch file and then prompts you as to where the new commands should be placed. You can either append them to end of the file or insert them at a given line number in the file.

Intelligent Backup's main menu displays the available options much as a simple database package would—in a straightforward vertical numbered menu. The backup and restore screens and user interface are much more elaborate, making use of function keys and Ctrl-key combinations. For example, F2 executes the crippled DOS shell (it accepts a CD command but does not implement it), F3 invokes the

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CIRCLE 317 ON READER SERVICE CARD

text editor (whose features, such as block copies and line insertions, are accessed by holding down the control key and a mnemonic letter key), and F7 brings up the PC's hardware configuration. *Intelligent Backup* is also the only program that includes an option for printing your own backup labels.

Intelligent Backup is one of the few programs reviewed here that allows you to back up more than one drive at any given session. If you have a hard disk with 32 megabytes or more of storage and have had to split it into two separate drives, you will find this feature more than useful. Also, users of Tempus-Link virtual drives will appreciate the detailed information on interfacing to mainframes.

Unlike DOS's BACKUP program, *Intelligent Backup* does not allow you to process an individual file to the exclusion of all others—at least not easily. What it does offer is total and incremental backups. Because the system maintains a history of backups and checks for updated files, it automatically decides which files are to be processed.

During backup, you are required to insert the last disk from the previous session. (If you use the program's ability to overwrite its own current backup disks, do not overwrite the last one.) The backup screen indicates estimations, completions, number of volumes, time, and files.

Intelligent Backup's restore facilities are far more flexible, letting you optionally reconcile deleted files and the backup volumes and indexes. Essentially, this means that you can mark archived files that have been intentionally deleted from the drive so that they are excluded from the restore operation. If later you decide you need the file, you can override the exclusion.

If you wish to restore to another drive, you need to convince the program that its indexes were wiped out. To do this, you

PC MAGAZINE FACT FILE

***Intelligent Backup*, Version 2.10**
Sterling Software
202 E. Airport Dr., #280
San Bernardino, CA 92408
(714) 889-0226

List Price: $149.95
Requires: 320K RAM, hard disk drive, DOS 2.0 or later.
In Short: A full-featured backup/restore program for the corporate environment that may be too rigid for the individual user. Not copy protected.

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■ BACKUP SOFTWARE

must install the program on the second drive, start the restore procedure, rebuild the index from the last backup disk, and then restore the selected files.

Intelligent Backup's intelligence owes much to the indexes it builds and to your use of them. Because you can specify an index parameter and restore other indexes without altering the original ones, you are able to perform operations *Intelligent Backup* would not allow otherwise. Up to eight alternate index files are supported.

Intelligent Backup may be too rigid for many people, but for the corporate environment that requires regular backups it is a viable solution.

Jet

Jet, a $60 program from Tall Tree Systems, differs from most programs we reviewed in that it's a high-speed transfer utility rather than a backup/restore program. The distinction is subtle but important: transfer utilities can be used for more than simply moving files from one type of storage to another. Still, both types give essentially the same result—one or more files existing in two different places.

A command-driven program, *Jet* can be invoked through batch files, with options for backing up by date, archive bit, subdirectory, and file list, as well as a few more esoteric choices. *Jet*'s switches provide more flexibility and control than in most backup programs. Not only can the program reset the archive bit after processing, but it also lets you force a mandatory transfer, transfer only those source files having a later date and time than similarly named files on the target, transfer files only if they exist on the target media, and transfer zero-length files. You can also tell *Jet* to list the files being transferred and to prompt for continuation or cancellation. Unfortunately, *Jet* provides no on-line help in setting up switches and parameters; if you need the proper syntax, you must look at the manual.

■ There may be faster programs, but for $60, *Jet* gives you unparalleled power and flexibility.

Jet's ability to transfer files en masse is enhanced by its use of file lists—essentially text files containing filenames, with each followed by a carriage return/line feed. In these lists, you can designate files as exceptions (so that they do not get transferred) and delete files on the target that are not excluded. The only requirement in creating file lists for processing is maintaining an 11-character format; for example, a filename such as NEW.TXT must be padded with five spaces so that it reads NEW*****.TXT. On the plus side, because you can have different lists, you can customize batch files for all of your processing.

Included with the package is Jetdrive, a utility that will create up to four RAMdisks on popular memory boards. If you're building the RAMdisks on a JRAM board, the program gives you still more power, including the ability to create a 16-megabyte drive. Most impressive of all, it can survive a warm boot. Also included are a spooling program, a utility for changing the amount of memory allocated to DOS, and assembler source code listings.

There may be faster programs out there, but for only $60, *Jet* gives you unparalleled power and flexibility. One word of caution, however: a program this powerful can be dangerous in inexperienced hands. Make sure you use it properly.

PC MAGAZINE FACT FILE

TALL TREE SYSTEMS
JETDRIVE

***Jet*, Version 3.3**
Tall Tree Systems Inc.
2585 E. Bayshore Rd.
Palo Alto, CA 94303
(415) 493-1980
List Price: $60
Requires: 256K RAM, hard disk drive, DOS 2.0 or later.

In Short: An extremely powerful and flexible transfer utility that is easily learned and implemented. Its power may pose problems for the novice or the careless. Not copy protected.

CIRCLE 626 ON READER SERVICE CARD

KeepTrack Plus

The Finot Group's $79 *KeepTrack Plus* is one of several programs in this roundup with backup/restore operations that are part of a set of hard disk/file management utilities. Since all of those utilities share a unified interface, you can perform your backups and restorations with the same interface you use to reorganize your hard disk. Though not a dedicated backup program, *KeepTrack Plus* does offer enough flexibility for standalone systems and small corporate environments.

KeepTrack Plus allows both batch file and interactive processing. In the batch mode, you can instruct the program to back up and restore to different directories, to skip the "Insert Next Diskette" message, and to erase or not to erase the target medium. Missing, however, is the ability to exclude or include specific files in one operation. Through the program interface, too, the file selection flexibility differs from that of many other packages. While you can select via wildcards, *KeepTrack Plus* lets you designate only one wildcard at a time. Furthermore, instead of providing an include/exclude capability, the program makes you scroll through the various directories, marking or unmarking the files to be processed by highlighting them and then hitting the spacebar. Though this may sound tedious, *KeepTrack Plus*'s graphic tree actually simplifies the process and provides more control over the selection.

Unlike many backup programs, *KeepTrack Plus* needn't be configured for the number and types of drives available—the program automatically displays all viable target areas, including network drives. Although it supports 720K-byte 3½ inch drives, you occasionally need to juggle drive assignments to reconcile what DOS knows with what the program can handle. (Essentially, the designation depends on whether you're backing up to the drive or using it to format a disk.) Because the program lets you specify subdirectories, you can back up different drives to the same target. And, since *KeepTrack Plus* doesn't touch system files, you can never accidentally end up with an unbootable drive.

Restoring an entire session or an individual file is simple. You just select the restore function, highlight the files you're interested in, and begin. You can also restore through a batch file. Other options of *KeepTrack Plus* let you perform directory operations and move, copy, and delete individual files and groups of files. It also has a view file choice that includes the ability to set *DisplayWrite* and *WordStar* formats and to expand tabs.

Although the program doesn't generate a backup report specifically, it does produce a .TXT file that can serve as one. It specifies not only the files and directories backed up but also the time and volume labels. The on-disk documentation lists a few programs that are known to cause reliability problems—virtually all of them cache-oriented utilities, including Personal Computer Support Group's *Lightning*.

Some of *KeepTrack Plus*'s features are less elegant than they might be. For example, to get an estimate of the number of disks needed, you have to check the program's status window and then hunt through a wealth of information about your system to find what you want. Also, to verify the operation, you must set DOS's verify option before running the program.

If you're looking for a package to back up your own PC or XT, *KeepTrack Plus* is probably the best buy you'll find. It may not offer enough, however, if you need a dedicated backup program to service a large corporate environment.

PC MAGAZINE FACT FILE

***KeepTrack Plus*, Version 1.2**
The Finot Group
2390 El Camino Real, #3
Palo Alto, CA 94306
(800) 628-2828
(ext. 700)
(415) 322-6161
List Price: $79
Requires: 256K RAM, hard disk drive, DOS 2.0 or later.
In Short: A group of file management/hard disk utilities that includes a disk backup program. Fine for standalone systems and small corporations, but probably not powerful enough for large corporate environments. Not copy protected.

CIRCLE **625** ON READER SERVICE CARD

PC FullBak

Westlake Data Corp.'s $59.95 *PC FullBak* clones *Fastback*, and it is faster, though not much more flexible. *PC FullBak* offers both a menu-driven and a command-driven interface. The main menu stretches a *1-2-3*–style bar across the top of the screen. Selecting any of the five major functions—backup, restore, compare, modify, and list—accesses another menu. Choose modify and you'll get a variety of customization options: you can specify the target and source, the path, the density and number of tracks of the target, and the type of backup, including incremental and subdirectory inclusion. Like *Fastback*, *PC FullBak* does not allow specific inclusion and exclusion of files, creation of customized scripts (unless you consider a batch file a script), and processing by date. And since it has nothing but a high-speed mode, *PC FullBak* works only with floppy disks.

PC FullBak lets you append new files to the end of an existing backup set, either through its menu or by including the appropriate switch on the command line. The program prompts you to insert the last disk from the current backup, searches for the end of that backup, and starts appending from that point forward. When starting from scratch, *PC FullBak* creates a bad-track map on each disk as it formats and then avoids writing data to the tracks it has noted. You can tell *PC FullBak* to discard the bad-track map, however, and force a reformat of the disk.

Like *Fastback*, *PC FullBak* keeps the

PC MAGAZINE FACT FILE

PC FullBak
Westlake Data Corp.
P.O. Box 1711
Austin, TX 78767
(512) 328-1041
List Price: $59.95
Requires: 128K RAM, hard disk drive, DOS 2.0 or later.
In Short: A *Fastback* clone that clocks in even faster and offers just a bit more flexibility. Not copy protected.

CIRCLE **624** ON READER SERVICE CARD

target drive rotating during a backup, relieving you of the need to hit Return after you insert a disk and close the drive door. Because the drive keeps spinning, the program can start writing to disk immediately, a feature that speeds up the process. But this can cause problems. For instance, *Fastback* tests your drives and the DMA chip before completing its installation; if they don't pass, the program installs at a slower speed. In contrast, though the documentation for *PC FullBak* states that the program checks the system timer before processing, it mentions nothing about testing the drives or DMA chip. Even if it did, the program can't set itself to a slower speed—it automatically roars ahead in high gear.

As untrustworthy as the *Fastback* testing is (it can fail a DMA chip, for example, because of misaligned drives), it's far better than not testing the equipment at all. Even though our test system presented no problems for *PC FullBak*, that doesn't mean the program will work on your system just as well.

PC FullBak is certainly one of the fastest utilities we tested, so if you're backing up only to floppy disks and if speed is the key, it might be worth considering. If you need flexibility, however, you should look elsewhere.

Pdisk

Phoenix Technologies' *Pdisk* gives you plenty of flexibility at a list price of $145. Accessible either on the command line or through *1-2-3*–style menus, this collection of programs lets you back up and restore data, cache disk accesses, move and rename files, park a hard disk, and perform subdirectory operations. It's a powerful, attractive package.

The program's backup options alone are rather impressive. *Pdisk* lets you include and exclude files and directories, skip directories that are empty, and set global rules for hidden and system files, log creation, and format procedures. You can format all or part of the target medium, either in advance or on the fly. The program also has a Verbose option that will feed you a wealth of screen information.

Another *Pdisk* setting determines the transfer speed—an important option if you intend to back up to a device other than a floppy drive. *Pdisk* comes with three transfer speeds. The default speed, fast, works only with backups to floppies. The medium speed supports devices not completely compatible with IBM standards. And the slow speed allows you to direct the backup to devices other than a floppy drive. Although the default for the A: drive is 1.2 megabytes, *Pdisk* lets you choose 360K-byte disks as an option in a submenu. If you insert a 360K-byte floppy into the drive by mistake, don't worry: *Pdisk* will prompt you to insert the proper disk.

In addition to the usual features found in backup and restore programs, *Pdisk* lets you create and save new command files to help customize your backup procedures. These files can contain such information as the source, destination, file and directory inclusion and exclusion data, and other default settings. Though you can create and save your own default files, *Pdisk* gives you three preset for its major operations (tree directory, backup, and restore). Another customization feature will appeal to consultants and system integrators: with *Pdisk*, you can alter the program's help file using any ASCII text editor.

Pdisk has a few problems, however—mostly related to its screen, which is neither the most attractive nor the easiest in the world to use. The menu bar and cursor key help menu are squeezed within the upper third of the screen, leaving two-thirds sitting around unproductively. The screen bottom does fill with file names and assorted information during a backup, but only when you set the Verbose option. This squeezing of on-screen information seems unjustifiable for a program that doesn't work in the background. Also, an interface like *Pdisk*'s, which makes you trudge up and down through levels and sublevels of commands, is hardly what I'd call user friendly. Phoenix ought to revamp the menu structure to eliminate some of the sublevels and get more choices on each screen, either through pop-up windows for toggled information or through separate pull-down menus for the different operations.

These quibbles aside, however, Phoenix's *Pdisk* is an excellent and extremely powerful set of utilities.

PC MAGAZINE FACT FILE

***Pdisk*, Version 1.01**
Phoenix Technologies Ltd.
320 Norwood Park South
Norwood, MA 02062
(800) 344-7200
(617) 769-7020
List Price: $145

Requires: 256K RAM, hard disk drive, DOS 2.0 or later.

In Short: A flexible set of hard disk utilities that allows backups at three speeds and to a variety of devices. Not copy protected.

CIRCLE 623 ON READER SERVICE CARD

Quiksave

Micro Interfaces Corp.'s *Quiksave* shares the virtues of several other backup/restore programs: it works both through menus and from the command line, features normal- and high-speed modes, and can include and exclude designated files. Also like other high-speed programs, the $99 *Quiksave* has some problems formatting while it's backing up data.

Quiksave's installation program makes changes in your AUTOEXEC.BAT and CONFIG.SYS files, and though the effects aren't as odious as with other such programs, the design is poor. The program effectively defeats its own purpose: since it writes all of its CONFIG.SYS file commands ahead of those already in the file, the path command *Quiksave* adds is wiped out by your original path command once the file is executed.

While this isn't a major problem, others show up. During the installation, for instance, *Quiksave* gives you the option of including a prompt that forces the user to enter the correct date. But rather than simply displaying the date, if available, and letting you hit the return key, *Quiksave* makes you type in the date as MMDDYY—no dashes, no slashes. Also, though the menu interface seems ideal for a first-letter entry scheme, you must use the cursor keys to make a selection. Again, neither implementation affects the program's performance, but they do affect the learning curve and, ultimately, the program's ease of use.

Quiksave does have a few features that make processing somewhat friendlier, such as the marking of split files during a restore operation. Also, you can restore files selectively by tagging them. *Quiksave* lets you save several different configurations for backup and restore procedures, too, and use the configurations in a batch file. This gives you a way to customize your procedures and still retain ease of use—for example, you can have one configuration to back up only your database files and another to back up your word processing documents. *Quiksave* also provides programs that let you run CHKDSK from within the main menu, obtain information about the status of the backup configurations currently in use, and track backup schedules (with an automatic display message to warn you when they're overdue).

Like Fifth Generation Systems' *Fastback*, *Quiksave* keeps the floppy drive spinning while disks are being inserted or removed. *Quiksave* also flatters another program by imitating it: the package seems to use the same proprietary format as Core International's *Corefast*. When we fed it disks previously formatted by *Corefast*, *Quiksave* didn't bat an eye, backing up the files without formatting the disks. Unfortunately, *Quiksave* also emulated *Corefast*'s tendency to crash while formatting disks and backing up data.

Restoring an entire drive after a crash or a reformatting (accidental or intentional) involves transferring the DOS system files, running the *Quiksave* installation

PC MAGAZINE FACT FILE

Quiksave
Micro Interfaces Corp.
16359 NW 57th Ave.
Hialeah, FL 33014
(800) 637-7226
List Price: $99
Requires: 256K RAM, hard disk drive, DOS 2.0 or later.
In Short: A dual-mode backup program that offers flexibility and speed but has some problems in its high-speed mode. Not copy protected.

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procedure, calling up the QSMENU main menu, and choosing the Selective Restore option. You then restore the catalog files from the last backup and use the Display Hard Disk Catalog feature to restore the files you need. Though it sounds like a bit much, it's actually quite easy.

Quiksave's installation isn't the smoothest, and the product has a few problems in its fast mode of operation (but then, so do the other high-speed programs). Though the package has some fine qualities, there are simply better backup programs in this roundup.

Sav-Key

Unlike other programs in this roundup, Business-Pro's $89.95 *Sav-Key* is not a backup/restore program per se. It is a front-end to DOS's BACKUP and RESTORE commands. Thus its performance and reliability are really DOS's. What *Sav-Key* adds is an easy-to-use, but limited, interface to DOS's programs.

As a management tool rather than a utility tool, it provides the user with a means of performing an ordered, regular backup routine. It forces you to maintain both full and daily backups within a rotational schedule. To implement this, *Sav-Key* uses a menu-driven interface.

The new version of *Sav-Key* is a marked improvement over the old. It can now search subdirectories and does not touch the batch file as the former version did. Installing *Sav-Key*, Version 3.0, is not as easy as it could be. Instead of giving you a dedicated batch file or installation program, it asks you to copy files to appropriate directories and amend the path command yourself.

Sav-Key's customization program allows you to configure the program's colors; the printer's escape code sequences; and the user, system, and backup information. Among other things, the information establishes the number and types of back-

PC MAGAZINE FACT FILE

***Sav-Key*, Version 3.0**
Business-Pro
P.O. Box 44075
Phoenix, AZ 85064
(602) 996-6547
List Price: $89.95
Requires: 128K RAM, hard disk drive, DOS 2.0 or later.
In Short: A front-end to DOS's BACKUP program that limits its functionality while forcing scheduled backups. Not copy protected.

CIRCLE 621 ON READER SERVICE CARD

"LAP-LINK IS NOTHING SHORT OF INCREDIBLE..."

1987 PC MAGAZINE Editors Choice

Jerry Pournelle
Byte Magazine, July 1987

They are still talking about LAP-LINK release #1. It has achieved virtually an unanimous editor's choice as THE solution for connecting laptop PC's and the new IBM PS/2 series with any 5¼ inch disk PC. LAP-LINK eliminates the need to purchase expensive external disk drives. Even if you own an external disk drive, LAP-LINK's incredible transfer speeds are much faster than a normal disk copy—transfer megabytes of information in just minutes! And since LAP-LINK weighs only ten ounces (cable and disk), you can easily carry it with you for instant connectivity at any location.

Unlike other transfer programs, there is absolutely NO installation required to use LAP-LINK. No messy changes to your CONFIG.SYS file or rebooting. Just type"LL" and LAP-LINK automatically connects itself. And LAP-LINK works between any version 2.xx or 3.xx of the MS-DOS/PC-DOS operating system.

LAP-LINK users couldn't agree more with Jerry Pournelle, "I don't know if the manual is any good or not: I've never had any reason to open it. LAP-LINK is so thoroughly intuitive, fast and simple to use that the manual is blooming near superfluous. This is one of those products that sets standards: it does what it's supposed to do, does it well, and does it without fuss or bother...."

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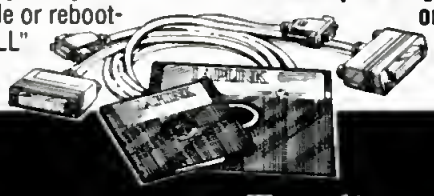

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Traveling Software

CIRCLE 223 ON READER SERVICE CARD

ups performed, the starting directory, the target drive, the disk parking status, and the exit option (whether you can exit to DOS after terminating the program or get to see a message that tells you to turn off the computer).

Although *Sav-Key* doesn't have much flexibility, it does change the date and number of the last backup so you can avoid a full backup. This is extremely useful if you have just installed a space-hungry program such as *R:base System V* or *dBASE III Plus*.

Forcing a partial backup of a specific file is somewhat more convoluted. Because *Sav-Key*'s partial backup processes files according to their dates, only those created or modified since the last full backup are included in the operation. As a result, you cannot reprocess a given file unless you do it immediately by erasing the previous backup record or setting back the system date by a day—or you can use BACKUP without *Sav-Key*. In all three cases, the process involves an understanding of DOS.

The restore procedure has also improved greatly. Previously, if you had to restore a file, you needed to execute DOS's RESTORE program from the system disk. Now, you need do that only if the hard disk crashes and you are restoring the entire drive. Individual files can be restored, without the additional disk swap, from within *Sav-Key*. Unfortunately, the menu asks that you enter the filename using the format shown in the backup directory listing. There is no way for you to get the filename from within the restore menu.

Because the report generated is sent only to the printer, you must be certain it is on-line. If not, your system will freeze for a while. Business-Pro should seriously consider sending the report to the screen as well.

Ultimately, *Sav-Key* is a progam for people who wish to use DOS backup procedures with a user interface.

Sy-Stor

In *Sy-Stor*, Sytron Corp. has an elegant collection of utilities that combine backup/restore processes with unparalleled flexibility. The program, which lists for $149.95, can include and exclude files and directories, features a utility for batch file creation, and even lets you run an operation after you've left the office. *Sy-Stor* is definitely a solid contender in corporate environments.

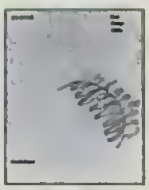
Users of several popular tape subsystems may find the *Sy-Stor* interface somewhat familiar: Sytron also licenses a backup/restore program to major tape vendors. Use of this common interface could be a plus for corporations, since it would cut down on training time. *Sy-Stor* actually offers two menu interfaces in addition to a command-line scheme. The novice interface, accessed through function keys, allows only total and modified backups but has a verification option for both backups and restorations. The more advanced interface, with a *1-2-3*–style menu bar, divides the screen into four windows: one each for messages, main disk, archive disk, and statistics. When you select an option, it brings you down to the next menu level, where more-specific choices are available to choose from.

Sy-Stor's advanced menu may give you more control over file selection than you really need. You can include and exclude files by name, by wildcard, or by marking them in the message window. Additionally, you can set the program to append files to the last operation's run, can specify the type of backup to be performed (modified or within a date range), and you can restore to the original source or a different one. *Sy-Stor* lets you set Ctrl-Break so that you can abort a session. It also allows you to activate the library, and it can estimate the number of disks needed for a backup. The program has a facility for establishing security and passwords that lets an administrator limit individual users in a multiuser system to backing up and restoring files in specified paths.

Restorations with *Sy-Stor* use the same interface as backups, so there's virtually no learning curve. You simply select restore, specify the file or files to be processed, and *Sy-Stor* takes over from there.

EDITOR'S CHOICE

PC MAGAZINE FACT FILE



Sy-Stor
Sytron Corp.
135 Maple Street
Marlboro, MA 01752
(800) 851-0020
(617) 460-0106
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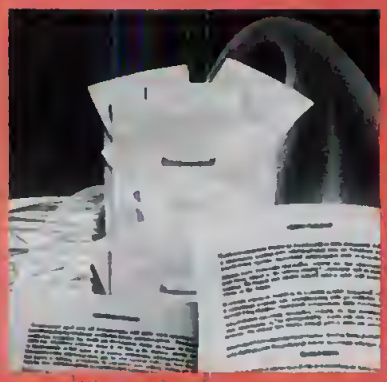

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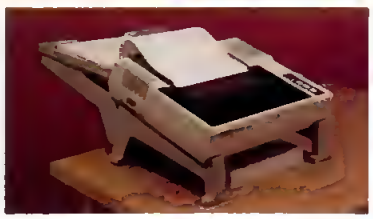

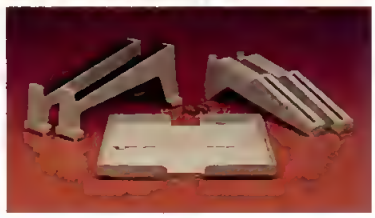

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PC MAGAZINE

HELP FILE

Volume 6
Number 18
October 27, 1987

This *PC Magazine* Help File is the first in a series of handy pull-out reference cards. Most serious users end up cluttering their desks with scraps of paper containing tables, charts, and command lists. To help you organize things better and work more efficiently, we'll provide a card filled with useful information like this periodically; just tear it out and pin it to the wall. Next we'll publish the first of several DOS command summaries. In future issues we'll publish Help Files that assist you with other key areas of your system and with many of today's most popular software applications.

The ASCII chart below contains the standard "low-bit" characters (values up to and including 127) used by just about every microcomputer, as well as the IBM "extended," or "high-bit," set (with values greater than 127) that you can use to create foreign language characters, fancy boxes, borders, and mathematical formulas. It also displays the decimal and hexadecimal values for each character so you can turn it into a hex/decimal conversion table.

To use any of the ASCII characters, either type in the character directly (if it's a letter or number) or hold down the Alt key, type in the character's decimal ASCII value — on your numeric keypad, not on the top row — and then release the Alt key. The ASCII character should appear on your screen at the current cursor position. You can also use them when writing programs by entering the number in the proper syntax; a PRINT CHR$(219) will produce a solid block in BASIC.

IBM ASCII Chart

Ctrl	Dec	Hex	Char	Code
@	0	00	(1)	NUL
A	1	01	☺	SOH
B	2	02	☻	STX
C	3	03	♥	ETX
D	4	04	♦	EOT
E	5	05	♣	ENQ
F	6	06	♠	ACK
G	7	07	•	BEL
H	8	08	◘	BS
I	9	09	○	HT
J	10	0A	◙	LF
K	11	0B	♂	VT
L	12	0C	♀	FF
M	13	0D	♪	CR
N	14	0E	♫	SO
O	15	0F	☼	SI
P	16	10	►	DLE
Q	17	11	◄	DC1
R	18	12	↕	DC2
S	19	13	‼	DC3
T	20	14	¶	DC4
U	21	15	§	NAK
V	22	16	▬	SYN
W	23	17	↨	ETB
X	24	18	↑	CAN
Y	25	19	↓	EM
Z	26	1A	→	SUB
[	27	1B	←	ESC
\	28	1C	∟	FS
]	29	1D	↔	GS
^	30	1E	▲	RS
_	31	1F	▼	US

Dec	Hex	Char
32	20	(2)
33	21	!
34	22	"
35	23	#
36	24	$
37	25	%
38	26	&
39	27	'
40	28	(
41	29	)
42	2A	*
43	2B	+
44	2C	,
45	2D	-
46	2E	.
47	2F	/
48	30	0
49	32	1
50	32	2
51	33	3
52	34	4
53	35	5
54	36	6
55	37	7
56	38	8
57	39	9
58	3A	:
59	3B	;
60	3C	<
61	3D	=
62	3E	>
63	3F	?

Dec	Hex	Char
64	40	@
65	41	A
66	42	B
67	43	C
68	44	D
69	45	E
70	46	F
71	47	G
72	48	H
73	49	I
74	4A	J
75	4B	K
76	4C	L
77	4D	M
78	4E	N
79	4F	O
80	50	P
81	51	Q
82	52	R
83	53	S
84	54	T
85	55	U
86	56	V
87	57	W
88	58	X
89	59	Y
90	5A	Z
91	5B	[
92	5C	\
93	5D	]
94	5E	^
95	5F	_

Dec	Hex	Char
96	60	`
97	61	a
98	62	b
99	63	c
100	64	d
101	65	e
102	66	f
103	67	g
104	68	h
105	69	i
106	6A	j
107	6B	k
108	6C	l
109	6D	m
110	6E	n
111	6F	o
112	70	p
113	71	q
114	72	r
115	73	s
116	74	t
117	75	u
118	76	v
119	77	w
120	78	x
121	79	y
122	7A	z
123	7B	{
124	7C	¦
125	7D	}
126	7E	~
127	7F	⌂

Dec	Hex	Char
128	80	Ç
129	81	ü
130	82	é
131	83	â
132	84	ä
133	85	à
134	86	å
135	87	ç
136	88	ê
137	89	ë
138	8A	è
139	8B	ï
140	8C	î
141	8D	ì
142	8E	Ä
143	8F	Å
144	90	É
145	91	æ
146	92	Æ
147	93	ô
148	94	ö
149	95	ò
150	96	û
151	97	ù
152	98	ÿ
153	99	Ö
154	9A	Ü
155	9B	¢
156	9C	£
157	9D	¥
158	9E	Pt
159	9F	ƒ

Dec	Hex	Char
160	A0	á
161	A1	í
162	A2	ó
163	A3	ú
164	A4	ñ
165	A5	Ñ
166	A6	ª
167	A7	º
168	A8	¿
169	A9	⌐
170	AA	¬
171	AB	½
172	AC	¼
173	AD	¡
174	AE	«
175	AF	»
176	B0	▒
177	B1	▒
178	B2	▓
179	B3	│
180	B4	┤
181	B5	╡
182	B6	╢
183	B7	╖
184	B8	╕
185	B9	╣
186	BA	║
187	BB	╗
188	BC	╝
189	BD	╜
190	BE	╛
191	BF	┐

Dec	Hex	Char
192	C0	└
193	C1	┴
194	C2	┬
195	C3	├
196	C4	─
197	C5	┼
198	C6	╞
199	C7	╟
200	C8	╚
201	C9	╔
202	CA	╩
203	CB	╦
204	CC	╠
205	CD	═
206	CE	╬
207	CF	╧
208	D0	╨
209	D1	╤
210	D2	╥
211	D3	╙
212	D4	╘
213	D5	╒
214	D6	╓
215	D7	╫
216	D8	╪
217	D9	┘
218	DA	┌
219	DB	▉
220	DC	▄
221	DD	▌
222	DE	▐
223	DF	▀

Dec	Hex	Char
224	E0	α
225	E1	ß
226	E2	Γ
227	E3	π
228	E4	Σ
229	E5	σ
230	E6	µ
231	E7	τ
232	E8	Φ
233	E9	Θ
234	EA	Ω
235	EB	δ
236	EC	∞
237	ED	∅
238	EE	∈
239	EF	∩
240	F0	≡
241	F1	±
242	F2	≥
243	F3	≤
244	F4	⌠
245	F5	⌡
246	F6	÷
247	F7	≈
248	F8	°
249	F9	∙
250	FA	·
251	FB	√
252	FC	n
253	FD	2
254	FE	■
255	FF	(3)

(1) Null (2) Space (3) Blank

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Also, if you're backing up to a device, such as a tape drive, that doesn't require your constant attention, you can set *Sy-Stor* to start backing up after you've left for the day.

The command-line interface requires setting the first character of each menu selection as a parameter. This can involve quite a number of letters, and you're unlikely to use it ad hoc, but you may want to use it in batch files. *Sy-Stor* helps you create these files through a utility called SS-Batch. Basically, the program prompts you for the batch file's name and then presents you with the advanced menu bar; creating the file entails simply selecting the appropriate commands and entering the desired filenames. Also, because the include/exclude files are saved separately, you can customize a batch operation to your liking by merely specifying which file is to be used.

Of the programs we reviewed, *Sy-Stor* probably has the most elegant interface and the greatest flexibility. Its configuration program lets administrators set up default operations easily and gives users an interface they can deal with. If you're not already using *Sy-Stor*, you probably will be after seeing it in action.

TakeTwo

United Software Security's *TakeTwo*, Version 1.10, which lists for $165, offers both batch- and menu-driven operations, the ability to direct the target to any legal DOS device, and excellent control over backup and restore options. Because of its ease of use, reasonable interface, and flexibility, it is one of the best programs reviewed. *TakeTwo Manager*—a new and more powerful $139 backup program recently released by USS—promises even greater flexibility.

Like many other programs, *TakeTwo* uses a DOS format. As a result, you can use the program with any legal DOS device, including removable hard disks and LANs. Support for file servers includes a timer program that facilitates processing by allowing you to set a time for the backup to begin, as well as a command line parameter that bypasses user input. There is also limited support for exit status codes in batch files. USS has promised a big file manager, similar to *X-Tree*'s, as a key addition in *TakeTwo Manager*.

During backup and restore operations, *TakeTwo* displays appropriate status information. In addition to the number of files, bytes, and floppies needed, such information as the percentage completed, the volume name, and the rate of data transfer is included. *TakeTwo* allows you to configure individual files into categories. This enables you to mark a file to be regularly processed (on update or after a given number of days), backed up once, or never backed up.

If you were to inspect a backup volume, you would find the archived files stored in a subdirectory whose name includes the date of the backup. Because the files are set as read-only, they cannot be accidently deleted. When backing up individual small files, *TakeTwo* may be slower than many of the other programs reviewed. This is because of the amount of time spent writing catalogs and indexes to both the floppy and the hard disk. When *TakeTwo* deals with large files or an entire drive's contents, though, the speed approaches that of high-speed programs.

TakeTwo's restore operation provides more flexibility than many other similar programs. Since restoring files involves providing the destination and the filename, you can direct the transfer to a different drive and directory or to the directory of origin but with a different name.

The historical catalog provides you with an extensive record of the program's use. Among other things, it will show the type of backup, the backup category, and the age of the backup in days. You can also view earlier versions of a backup, a nice feature for finding a file that was subsequently deleted from the hard disk.

One of the new features is a DOS prompt shell that you can invoke even during a backup operation simply by hitting F2. When you are finished and wish to resume backing up, the backup process continues from the point at which it paused. Enhancements in *TakeTwo Manager* include a set of memory-resident programs that will enhance DOS's utility.

TakeTwo is one of the easiest and most complete backup and restore products on the market today. It may not provide the flexibility of a program such as Tall Tree's *Jet* and it may not be as fast as the high-speed programs, but it is menu driven, provides uncommon control over backups and restores, and generates the type of reports corporations require. If you don't include *TakeTwo* when evaluating backup/restore programs, you are excluding safety, ease of use, and reliability. PC

Vincent Puglia is a frequent contributor to PC Magazine.

EDITOR'S CHOICE

FACT FILE

***TakeTwo*, Version 1.10**
United Software Security Inc.
8133 Leesburgh Pike
Vienna, VA 22180
(800) 892-0007
(703) 556-0007
List Price: $165;
TakeTwo Manager, $139.
Requires: 256K RAM, hard disk drive, DOS 2.1 or later.
In Short: An easy-to-use-and-maintain backup program that provides features galore. Not copy protected.

CIRCLE 619 ON READER SERVICE CARD

EDITOR'S CHOICE

- **Sy-Stor**
- **TakeTwo**

Backup/restore software is getting friendlier, more flexible, and more powerful. Most of the programs reviewed here will solve your archiving needs, but two stood out.

United Software Security's TakeTwo *provides an easy-to-use interface, DOS reliability, and enough flexibility to satisfy most users—and a new version,* TakeTwo Manager, *has enough memory-resident utilities to worry established TSR vendors. If you want both high- and normal-speed operations, consider Sytron's* Sy-Stor. *Its flexibility makes it ideal for both corporate and individual use.*

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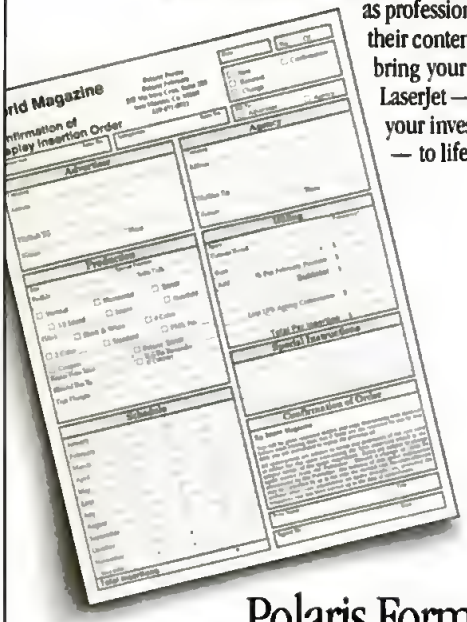

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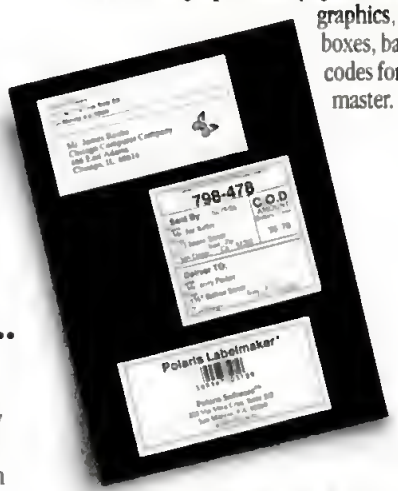

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CIRCLE 379 ON READER SERVICE CARD

■ PC LAB NOTES: FASTER BASIC ■ ETHAN WINER

FAST SCREEN WRITING IN BASIC, PART 2

In addition to speeding up screen printing, adding assembler routines to your BASIC, QuickBASIC, and Turbo Basic programs lets you create instant help and message windows.

In the first part of this article I showed how to include assembly language routines that can locate and print BASIC strings with the professional speed your programs need to be competitive. This involved, among other things, determining the type of display adapter in use and preventing snow on a CGA screen. In this continuation of that discussion we'll take a close look at the mechanics of saving and restoring the screen for windowing, along with a number of related topics. As with the quick printing routines, assembly language must be used if the saving and restoring operations are to be acceptably fast.

SAVING THE SCREEN Before a pop-up utility such as Borland's *SideKick* overwrites the current screen with its notepad or calculator, it must first save what was already there. Otherwise, there would be no way to restore the original contents later on. Likewise, if we are to add windowing to a BASIC program, a safe place must be found to save the current screen temporarily. In this article, the routines I'll present will use an integer array for the storage buffer.

Using an array has several advantages over most of the other possible approaches for reserving memory. For one thing, it's simple to do and, for another, multiple arrays can be used to store more than one screen. Further, only the amount of memory actually needed can be set aside when the array is dimensioned. Thus, even though a BASIC array is really meant to hold a table of values, we can take advantage of the fact that all of its elements are in contiguous memory locations.

We noted last time that two bytes of memory are used for each character position on the screen. The first byte holds the ASCII value for the character, while the second holds its color or "attribute." This works out well for using an integer array as the storage buffer, because each element can hold two bytes. To save the top four lines of the screen, for example, the array would be dimensioned to 4 times 80, or 320. In practice, the array really only needs to be dimensioned to 319, because element zero is also available.

Before saving any portions of the screen, however, we must determine both the segment and address where the array is to be kept. In the BASIC interpreter this is easy, since all variables are kept in the same default segment and VARPTR can be used to report where the first array element is located. However, this also means that for each screen buffer we wish to reserve, that many bytes will be taken from the memory available to a program and its data.

BASIC DIFFERENCES QuickBASIC and Turbo Basic can use a $Dynamic (far) array to hold the screen instead. This has the great advantage that it does not steal any string or normal variable space. But since a far array could be located anywhere in memory, you have to find its segment as well as its address. Turbo Basic provides the VARSEG function for just this purpose. QuickBASIC 3.0 has no direct equivalent, so in QB you need a few extra steps to obtain the complete array address.

A special assembler routine called PTR86 comes on the QuickBASIC distribution disk. It takes the single precision address returned by VARPTR and splits it into separate integer segment and address values. Since PTR86 is an external routine, you will have to include it in your user

PRODUCTIVITY INDEX

PC LAB NOTES
Saving and restoring BASIC, Turbo Basic, and QuickBASIC screens.
UTILITIES
SNIPPER snatches any part of the screen and copies it where you like.
ENVIRONMENTS
OS/2 function calls allow high-level talk to the operating system.
SPREADSHEET CLINIC
Saving unfinished formulas; @if and @sum bug; function key menus.
USER-TO-USER
Multiple-filespec copying the easy way; a TYPE that stops at nothing.
POWER USER
WordPerfect to *Word* converts; full control over remote *Crosstalks*.
LANGUAGES
How BASIC stacks up in memory; wrap master BASIC.
PC TUTOR
Overlays uncovered; cracking the codes to redefine the keys.
CONNECTIVITY CLINIC
Rate hikes on information services; poltergeist activity on networks.

■ PC LAB NOTES

libraries or link it to each program you create. In QuickBASIC 2.0, PTR86 is contained in the file USERLIB.OBJ; in later versions it has been moved to INT86.OBJ.

The program fragment below first dimensions an integer array large enough to hold the entire screen and then calls upon PTR86 to find where in memory the array is located.

```
Dim Storage%(1999)
Call Ptr86(Segment, Address, Varptr(Storage%(0)))
```

PTR86 returns the Segment and Address variables holding the complete address of the storage array, ready to be passed to the assembly language windowing routines. Normally, VARPTR reports the address of both near and far array variables as an offset from BASIC's default data segment. For $Static (near) arrays, the offset will always be less than 65536, so it is not difficult to represent it as an integer. (Negative values can be used when the address exceeds 32767.) But all $Dynamic arrays are located beyond that segment, so the addresses are necessarily greater.

(Some readers might ask at this point why a floating-point offset couldn't simply be passed to the assembler routine directly. While this is possible, floating-point numbers are much more difficult to deal with in assembly language than integers are. Besides, beyond the extra code required, the format for storing floating-point numbers

```
'***** Windo.Bas - demonstrates saving/restoring the screen

Dim Shared Storage%(80 * 24)            'set aside memory to hold the screen

For X = 1 To 24                         'fill screen with X's for demo
    Print String$(80,"X");
Next

StartLine = 1
NumLines = 24

Call ScrSave(StartLine, NumLines)       'save the screen lines 1 - 25
Locate 25, 1
Print "Press any key: ";
While Inkey$ = "" : Wend                'pause for a keypress
Cls                                     'clear screen to prove it worked
Call ScrRest(StartLine, NumLines)       'restore screen


Sub ScrSave(StartLine, NumLines) Static

    StoreAddr = Varptr(Storage%(0))     'find where the storage memory is

    StartAddr = (StartLine - 1) * 160   '-1 because address starts at zero
    NumBytes  = NumLines * 160          '* 160 for 80 chars and 80 color bytes
    For X = 0 To NumBytes - 1           '-1 adjusts for base 0, rather than 1
        Def Seg = &HB800                'use &H8000 for a mono screen
        Byte = Peek(StartAddr + X)      'get the byte in screen memory
        Def Seg                         'now go back to BASIC's segment
        Poke StoreAddr + X, Byte        'and poke the byte into the array
    Next

End Sub


Sub ScrRest(StartLine, NumLines) Static

    StoreAddr = Varptr(Storage%(0))     'find where the storage memory is

    StartAddr = (StartLine - 1) * 160   '-1 because address starts at zero
    NumBytes  = NumLines * 160          '* 160 for 80 chars and 80 color bytes

    For X = 0 To NumBytes - 1           'as above
        Def Seg                         'use BASIC's segment to access array
        Byte = Peek(StoreAddr + X)      'get the byte in array memory
        Def Seg = &HB800                'now go back to the screen segment
        Poke StartAddr + X, Byte
    Next

End Sub
```

Figure 1: *A QuickBASIC model for saving and restoring portions of the display screen.*

```
;SCRNSAVE.ASM - saves a portion of the text screen in the BASIC interpreter


cnde        Segment Byte
            Assume  CS:Code

ScrnSave    Proc    Far

Start_Addr  Equ     $               ;identify the program's starting address
Begin:      DB      0FDh            ;fake the header BASIC uses for BLOAD
            DW      0, 0            ;phony segment and address
            DW      End_Addr - Start_Addr    ;calculate this program's length

            Push    BP              ;save registers for BASIC
            Push    BS
            Push    DS
            Mov     BP,SP           ;locate stack to get variable addresses later

            Mov     DX,0            ;look at low memory using ES
            Mov     ES,DX
            Mov     BX,0B000h       ;assume mono screen segment for now
            Mov     AL,ES:[410h]    ;get the equipment list
            And     AL,48           ;just look at the monitor type
            Cmp     AL,48           ;is it mono?
            JZ      Get_Params      ;yes, skip over adding 800h
            Add     BX,800h         ;no, adjust for color screen memory

            Mov     AL,ES:[487h]    ;if an EGA is present, AL will not be zero
            Cmp     AL,0            ;is it an EGA?
            JNZ     Get_Params      ;yes, leave DX set to zero as a flag for later
            Mov     DX,3DAh         ;no, specify the port to check for retrace

Get_Params: Mov     AX,DS           ;make ES point to BASIC's default segment
            Mov     ES,AX
            Push    BX              ;save the screen segment for later
            Mov     SI,[BP+10]      ;get the starting address of the array
            Mov     DI,[SI]         ;and put it into DI

            Mov     SI,[BP+12]      ;get the address for LastLine
            Mov     AL,[SI]         ;and put it into AL
            Mov     CL,160          ;prepare to multiple times 160
            Mul     CL              ;now AX holds the last screen address to save
            Mov     BX,AX           ;save it in BX for later

            Mov     SI,[BP+14]      ;get the address for FirstLine
            Mov     AL,[SI]         ;put it into AL
            Dec     AL              ;adjust 1-25 to 0-24
            Mul     CL              ;calculate actual starting address on screen
            Mov     SI,AX           ;now SI points to the source address
            Sub     BX,AX           ;calculate the number of bytes to copy
            Mov     CX,BX           ;put it into CX for Rep or Loop below
            Shr     CX,1            ;divide CX by 2 to obtain the number of words

            Pop     DS              ;retrieve the screen segment saved earlier
            Cld                     ;all data moves below will be forward
            Cmp     DL,0            ;are we doing monochrome or EGA?
            JZ      Mono            ;yes, skip over the retrace stuff

No_Retrace: In      AL,DX           ;get the video status byte
            Test    AL,1            ;test just the horizontal retrace bit
            JNZ     No_Retrace      ;if doing a retrace, wait until it's not
Retrace:    In      AL,DX           ;get the status byte again
            Test    AL,1            ;are we currently doing a retrace?
            JZ      Retrace         ;no wait until we are
            Lodsw                   ;now get the word from the screen
            Stosw                   ;and put it into the array
            Loop    No_Retrace      ;loop until done
            Jmp     Exit            ;skip over the mono routine and exit

Mono:       Rep     Movsw           ;move the data in one operation

Exit:       Pop     DS              ;restore registers for BASIC
            Pop     ES
            Pop     BP
            Ret     6               ;return skipping the passed parameters
End_Addr    Equ     $               ;identify the program's ending address

ScrnSave    Endp
Code        Ends
            End     Begin
```

Figure 2: *SCRNSAVE.ASM will save a portion of the display screen in the BASIC interpreter. Assemble this routine with MASM, then LINK, and finally EXE2BIN.*

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PC Magazine receives hundreds of reader tips and tricks each week. We're always eager to hear your good ideas that help others work faster, smarter, and better. And we pay from $50 to $250 for each one we publish, depending on complexity, plus a $25 bonus for sending them in on a disk.

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in BASIC is currently changing.

Beginning with QuickBASIC, Version 3.0, which supports the 8087 math coprocessor, Microsoft has begun to abandon its proprietary floating-point format. Microsoft currently offers the IEEE format as an option, and with the introduction of QB, Version 4.0, the IEEE format will be the *only* one the company supports for all of its compiled languages. Needless to say, any assembly language routines that rely upon the old Microsoft-style floating-point numbers today will be doomed to obsolescence tomorrow. Thus, we're best to stick with integers at present.)

Following the procedure in Part 1's treatment of the quick printing routines, a complete implementation of the screen saving and restoring routines is shown first in BASIC (see Figure 1). The BASICA assembler code is then presented, as are the modified versions that accommodate the QuickBASIC and Turbo Basic compilers. There are sufficient differences between each version to warrant separate program listings.

There are several ways to specify which portion of a screen is to be saved and restored, but in the interest of simplicity the programs here will deal with entire lines. That way, only the starting and ending lines need to be passed to the windowing routines.

You should notice in Figure 1 the extra steps required to adjust the line numbers that are numbered beginning at 1 to memory addresses, which begin at 0. Observe, too, how the segments to peek and poke must be toggled for each character, since BASIC can keep track of only one segment at a time.

The assembler implementation for use with the BASIC interpreter is shown in Figures 2 and 3, and a BASIC demo that calls them is given in Figure 4. This version deviates slightly from the model, in that the segment of the storage array is located within BASIC's default data segment. When we convert the routine for use with QuickBASIC and Turbo Basic, a far array will be used instead, so the added information will be required.

> ■ Any assembly language routines that rely upon the old Microsoft-style floating-point numbers today will be doomed to obsolescence tomorrow.

As in the first part, we create a fake header to facilitate BLOADing the assembled code into an integer array. Next, the BIOS data area is examined to see what type of adapter is installed, so the proper video segment will be used. Finally, if a color adapter is detected, the program looks further to see if it is a CGA or EGA. Remember, when a CGA is being used, extra steps are always required to avoid creating snow on the screen during the direct video memory reading and writing.

Since entire consecutive lines are being saved and restored, the address calculations and actual word moves are simplified considerably. If you were attempting to copy only selected portions of the screen—a rectangular box, for example—several additional steps would be needed. Even though the BASIC example in Figure 1 had to constantly switch between the array and video memory segments, the 8088 processor allows us to maintain two separate segments at once (DS and ES), which also helps to simplify the coding effort.

There is only one new trick that's used in the screen save routine for the interpreter—the use of the 8088 SHR instruction to divide the CX register by two. Once the starting and ending addresses have been calculated, the number of bytes is obtained by a simple subtraction. But since it's more efficient to move entire words, the number of bytes is divided by shifting the bits in CX to the right by one. (Actually, moving words instead of byte pairs is faster only on machines that are equipped with an 8086, 80286, or 80386 microprocessor. When you tell an 8088 microprocessor to

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fetch or store a word from memory, it actually performs two separate 1-byte moves internally.)

Figure 3 below shows the corresponding screen restore routine for the BASIC interpreter, which operates almost identically to the screen save routine, except that the DS and ES registers are exchanged. As we already saw in Part 1 of this article, the 8088 has several instructions dedicated to moving bytes or words around in memory. The DS:SI register pair shows where they are to come from (the source), and ES:DI instead indicate where they are to go (the destination).

■ The screen restore routine operates almost identically to the screen save routine, except that the DS and ES registers are exchanged.

You must assemble these routines with the Microsoft or IBM macro assembler (Version 2.0 or later), link them, and then convert them to a binary file with EXE2BIN, as shown in the extract below. (Substitute the appropriate .ASM filename for the QPRINT example shown.) Ignore the error message from LINK about not having a stack segment—this is normal for programs that will end up in a .COM or .BIN format.

```
MASM QPRINT;
LINK QPRINT;
EXE2BIN QPRINT
```

```
;SCRNREST.BAM - restores a portion of the text screen in the BASIC interpreter

;Note: Assemble this routine with MASM, then LINK, finally EXE2BIN

Code        Segment Byte
            Assume  CS:Code

ScrnRest    Proc    Far

Start_Addr  Equ     $               ;identify the program's starting address
Begin:      DB      0FDh            ;fake the header BASIC uses for BLOAD
            DW      0, 0            ;phony segment and address
            DW      End_Addr - Start_Addr    ;calculate this program's length

            Push    BP              ;save registers for BASIC
            Push    ES
            Mov     BP,SP           ;locate stack to get variable addresses later

            Mov     DX,0            ;look at low memory using ES
            Mov     ES,DX
            Mov     BX,0B000h       ;assume mono screen segment for now
            Mov     AL,ES:[410h]    ;get the equipment list
            and     AL,48           ;just look at the monitor type
            Cmp     AL,48           ;is it mono?
            JE      Get_Params      ;yes, skip over adding 800h
            Add     BX,800h         ;no, adjust for color screen memory

            Mov     AL,ES:[487h]    ;if an EGA is present, AL will not be zero
            Cmp     AL,0            ;is it an EGA?
            JNE     Get_Params      ;yes, leave DS set to zero as a flag for later
            Mov     AX,3DAh         ;no, specify the port to check for retrace

Get_Params: Mov     ES,BX           ;set ES to the appropriate screen segment
            Mov     SI,[BP+08]      ;get the starting address of the array
            Mov     SI,[SI]         ;and put it into SI

            Mov     DI,[BP+10]      ;get the address for LastLine
            Mov     AL,[DI]         ;and put it into AL
            Mov     CL,100          ;prepare to multiple times 100
            Mul     CL              ;now BX holds last screen address to restore
            Mov     BX,AX           ;save it in BX for later

            Mov     DI,[BP+12]      ;get the address for FirstLine
            Mov     AL,[DI]         ;put it into AL
            Dec     AL              ;adjust 1-25 to 0-24
            Mul     CL              ;calculate actual starting address on screen
            Mov     DI,AX           ;now DI points to the destination address

            Sub     BX,AX           ;calculate the number of bytes to copy
            Mov     CX,AX           ;put it into CX for Rep or Loop below
            Shr     CX,1            ;divide CX by 2 to obtain the number of words

            Cld                     ;all data moves below will be forward
            Cmp     DL,0            ;are we doing monochrome or EGA?
            JE      Mono            ;yes, skip over the retrace stuff

No_Retrace: In      AL,DX           ;get the video status byte
            Test    AL,1            ;test just the horizontal retrace bit
            JNZ     No_Retrace      ;if doing a retrace, wait until it's not
Retrace:    In      AL,DX           ;get the status byte again
            Test    AL,1            ;are we currently doing a retrace?
            Jz      Retrace         ;no wait until we are
            Lodsw                   ;now get the word from the screen
            Stosw                   ;and put it into the array
            Loop    No_Retrace      ;loop until done
            Jmp     Exit            ;skip over the mono routine and exit

Mono:       Rep     Movsw           ;move the data in one operation

Exit:       Pop     ES              ;restore registers for BASIC
            Pop     BP
            Ret     6               ;return skipping the passed parameters
End_Addr    Equ     $               ;identify the program's ending address

ScrnRest    Endp
Code        Ends
            End     Begin
```

Figure 3: *SCRNREST.ASM will restore a portion of the display screen when using the BASICA interpreter. Assemble this routine with MASM, then LINK, and finally EXE2BIN.*

```
100 'SCRNSAVE.BAS - demonstrates saving and restoring the screen
110 '
120 DEFINT A-Z
130 DIM STORAGE(1999), CODE.ARRAY(59), CODE2.ARRAY(58)
140 SADDR! = 0 : ADDR = 0 : SCRNSAVE! = 0 : SCRNREST! = 0
150 FIRSTLINE = 1 : LASTLINE = 5
160 '
170 SCRNSAVE! = VARPTR(CODE.ARRAY(0))
180 BLOAD "ScrnSave.Bin", SCRNSAVE!
190 SCRNREST! = VARPTR(CODE2.ARRAY(0))
200 BLOAD "ScrnRest.Bin", SCRNREST!
210 '
220 CLS
230 FOR E = 1 TO 15
240     COLOR E
250     PRINT STRING$(80, E + 64);
260 NEXT
270 '
280 LOCATE 20
290 PRINT "Press a key to save the screen";
300 WHILE INKEY$ = "" : WEND
310 SADDR! = VARPTR(STORAGE(0))
320 IF SADDR! > 32767 THEN ADDR = SADDR! - 65536! ELSE ADDR = SADDR!
330 SCRNSAVE! = VARPTR(CODE.ARRAY(0))
340 CALL SCRNSAVE!(FIRSTLINE, LASTLINE, ADDR)
350 '
360 CLS
370 PRINT "Press a key to restore the top";
380 WHILE INKEY$ = "" : WEND
390 EADDR! = VARPTR(STORAGE(0))
400 IF SADDR! > 32767 THEN ADDR = SADDR! - 65536! ELSE ADDR = SADDR!
410 SCRNREST! = VARPTR(CODE2.ARRAY(0))
420 CALL SCRNREST!(FIRSTLINE, LASTLINE, ADDR)
430 LOCATE 20
```

Figure 4: *The window routines for the BASIC interpreter are BLOADed into an array.*

ADAPTATIONS FOR QB AND TURBO

Because several changes are required to adapt these routines to QuickBASIC and Turbo Basic, I've provided separate source listings for each of these compilers. The major difference in the QuickBASIC implementation is that the segment and the address of the storage array must be passed to the assembler routine. This step is not required in Turbo Basic because Turbo passes both automatically when the routines are called. Figures 5 and 6 contain the assembler code for saving and restoring, respectively; Figure 7 gives an example of using the routines in QuickBASIC.

When you assemble these routines for QuickBASIC and then put them into a user library, be sure you also include the file INT86.OBJ if you are using QuickBASIC, Version 3.0, or USERLIB.OBJ if you are using Version 2.0. Otherwise, you will not be able to call upon the PTR86 routine to derive the segment and address for the storage integer array. No further steps are necessary to prepare these routines for use with QuickBASIC, since the object modules will be used directly.

```
;SCRNSAVE.ASM - saves a portion of the text screen in QuickBASIC

Code        Segment Byte Public 'Code'
            Assume  CS:Code
            Public  ScrnSave

ScrnSave    Proc    Far

Begin:      Push    BP              ;save registers for BASIC
            Push    DS
            Mov     BP,SP           ;locate stack to get variable addresses later

            Mov     DX,0            ;look at low memory using ES
            Mov     ES,DX
            Mov     BX,0B000h       ;assume mono screen segment for now
            Mov     AL,ES:[410h]    ;get the equipment list
            And     AL,48           ;just look at the monitor type
            Cmp     AL,48           ;is it Mono?
            JE      Get_Params      ;yes, skip over adding 800h
            Add     BX,800h         ;no, adjust for color screen memory

            Mov     AL,ES:[487h]    ;if an EGA is present, AL will not be zero
            Cmp     AL,0            ;is it an EGA?
            JNE     Get_Params      ;yes, leave DX set to zero as a flag for later
            Mov     DX,3DAh         ;no, specify the port to check for retrace

Get_Params: Push    BX              ;save the screen segment for later
            Mov     SI,[BP+08]      ;get the starting address of the storage array
            Mov     DI,[SI]         ;and put it into DI
            Mov     SI,[BP+10]      ;get the segment for the array
            Mov     ES,[SI]         ;and assign it to ES

            Mov     SI,[BP+12]      ;get the address for LastLine
            Mov     AL,[SI]         ;and put it into AL
            Mov     CL,160          ;prepare to multiple times 160
            Mul     CL              ;now AX holds the last screen address to save
            Mov     SI,AX           ;save it in SI for later

            Mov     SI,[BP+14]      ;get the address for FirstLine
            Mov     AL,[SI]         ;put it into AL
            Dec     AL              ;adjust 1-25 to 0-24
            Mul     CL              ;calculate actual starting address on screen
            Mov     SI,AX           ;now SI points to the source address

            Sub     BX,AX           ;calculate the number of bytes to copy
            Mov     CX,BX           ;put it into CX for Rep or Loop below
            Shr     CX,1            ;divide CX by 2 to obtain the number of words

            Pop     DS              ;retrieve the screen segment saved earlier
            Cld                     ;all data moves below will be forward
            Cmp     DL,0            ;are we doing monochrome or EGA?
            JE      Mono            ;yes, skip over the retrace stuff

No_Retrace: In      AL,DX           ;get the video status byte
            Test    AL,1            ;test just the horizontal retrace bit
            JNZ     No_Retrace      ;if doing a retrace, wait until it's not
Retrace:    In      AL,DX           ;get the status byte again
            Test    AL,1            ;are we currently doing a retrace?
            JE      Retrace         ;no wait until we are
            Lodsw                   ;now get the word from the screen
            Stosw                   ;and put it into the array
            Loop    No_Retrace      ;loop until done
            Jmp     Exit            ;skip over the mono routine and exit

Mono:       Rep     Movsw           ;move the data in one operation

Exit:       Pop     DS              ;restore registers for BASIC
            Pop     BP
            Ret     8               ;return skipping the passed parameters

ScrnSave    Endp
Code        Ends
            End     Begin
```

Figure 5: *The QuickBASIC version of SCRNSAVE.ASM.*

```
;SCRNREST.ASM - restores a portion of the text screen in QuickBASIC

Code        Segment Byte Public 'Code'
            Assume  CS:Code
            Public  ScrnRest

ScrnRest    Proc    Far

Begin:      Push    BP              ;save registers for BASIC
            Push    DS
            Mov     BP,SP           ;locate stack to get variable addresses later

            Mov     DX,0            ;look at low memory using ES
            Mov     ES,DX
            Mov     BX,0B000h       ;assume mono screen segment for now
            Mov     AL,ES:[410h]    ;get the equipment list
            And     AL,48           ;just look at the monitor type
            Cmp     AL,48           ;is it mono?
            JE      Get_Params      ;yes, skip over adding 800h
            Add     BX,800h         ;no, adjust for color screen memory

            Mov     AL,ES:[487h]    ;if an EGA is present, AL will not be zero
            Cmp     AL,0            ;is it an EGA?
            JNZ     Get_Params      ;yes, leave DX set to zero as a flag for later
            Mov     DX,3DAh         ;no, specify the port to check for retrace

Get_Params: Mov     ES,BX           ;set ES to the appropriate screen segment

            Mov     DI,[BP+12]      ;get the address for LastLine
            Mov     AL,[DI]         ;and put it into AL
            Mov     CL,160          ;prepare to multiple times 160
            Mul     CL              ;now AX holds last screen address to restore
            Mov     BX,AX           ;save it in BX for later

            Mov     DI,[BP+14]      ;get the address for FirstLine
            Mov     AL,[DI]         ;put it into AL
            Dec     AL              ;adjust 1-25 to 0-24
            Mul     CL              ;calculate actual starting address on screen
            Mov     DI,AX           ;now DI points to the destination address

            Sub     BX,AX           ;calculate the number of bytes to copy
            Mov     CX,BX           ;put it into CX for Rep or Loop below
            Shr     CX,1            ;divide CX by 2 to obtain the number of words

            Mov     SI,[BP+10]      ;get the segment of the storage array
            Mov     AX,[SI]         ;and save it in AX for a moment
            Mov     SI,[BP+08]      ;get the address of the first array element
            Mov     SI,[SI]         ;and put it into SI
            Mov     DS,AX           ;okay to change DS after getting all variables

            Cld                     ;all data moves below will be forward
            Cmp     DL,0            ;are we doing monochrome or EGA?
            JE      Mono            ;yes, skip over the retrace stuff

No_Retrace: In      AL,DX           ;get the video status byte
            Test    AL,1            ;test just the horizontal retrace bit
            JNE     No_Retrace      ;if doing a retrace, wait until it's not
Retrace:    In      AL,DX           ;get the status byte again
            Test    AL,1            ;are we currently doing a retrace?
            JE      Retrace         ;no wait until we are
            Lodsw                   ;now get the word from the screen
            Stosw                   ;and put it into the array
            Loop    No_Retrace      ;loop until done
            Jmp     Exit            ;skip over the mono routine and exit

Mono:       Rep     Movsw           ;move the data in one operation

Exit:       Pop     DS              ;restore registers for BASIC
            Pop     BP
            Ret     8               ;return skipping the passed parameters

ScrnRest    Endp
Code        Ends
            End     Begin
```

Figure 6: *The QuickBASIC version of SCRNREST.ASM.*

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Turbo Basic requires a binary format similar to that used by the interpreter, except the .BIN file is not BLOADed. You must still assemble and link the program files and then convert them with EXE2BIN, however. Since Turbo does not have the ability to include object files directly, I've chosen to use the $Inline metastatement to add these routines. This is shown in the BASIC example in Figure 8. Figures 9 and 10 comprise the assembler source code, as adapted for use with Turbo Basic compiler.

VIDEO PAGES The routines presented so far have assumed that the direct video writing will be to the default text page zero. CGA and EGA adapters can manage more than a single screenful—or page—of information. While only one page at a time can be displayed, several images (depending on the amount of memory installed) can be stored on the adapter card. BASIC programmers take advantage of this feature when they use the SCREEN command to quickly display text or graphics images that had been created previously.

```
'SCRNSAVE.BAS - demonstrataa saving and rastoring the scraan in QuickBASIC

Dafint A-Z

'$Dynamic
Dim Storage(1999)

FiratLina = 1
LnatLina  = 5

Cla
For X = 1 To 15
    Color X
    Print String$(80, X + 64);
Naxt

Locata 20
Print "Praaa n kay to anva tha scraan";
Whila Inkay$ = "" : Wand

Cnll Ptr86(Sagmant, Addraaa, Varptr(Storage(0))[
Call ScrnSava(FiratLina, LaatLina, Sagmant, Addraaa[

Cla
Print "Praaa a kay to rastora the top";
While Inkay$ = "" : Wand
Cnll Ptr86(Sagmant, Addraaa, Vnrptr(Storaga(0)))
Call ScrnRaat(FirstLina, LaatLina, Sagmant, Addraaa[
```

Figure 7: *Using the QB PTR86 routine to find the segment and address of an array.*

```
'SCRNSAVE.BAS - demonstrntaa anving nnd rastoring the acraan in Turbo Sasic

Dafint A-Z
Dim Dynamic Storage(1000)

FirstLina = 1
LaatLina  = 5

Cla
For X = 1 To 15
    Color X
    Print String$(80, X + 64);
Next

Locata 20
Print "Praaa a kay to anva the scraan";
Whila Inkay$ = "" : Wand

Call ScrnSnva(FirstLina, LastLine, Stornga(0)[

Cla
Print "Praaa n kay to rastora the top";
Whila Inkay$ = "" : Wand
Call ScrnRast(FirstLina, LastLine, Stornga(0))

Sub ScrnSave Inline
    $Inline "ScrnSava.Sin"
End Sub

Sub ScrnRaat Inline
    $Inline "ScrnRaat.Sin"
End Sub
```

Figure 8: *Turbo Basic can use assembled files directly with the $Inline metastatement.*

```
;SCRNSAVE.ASM - saves n portion of the text screen in Turbo Sasic

Code        Segment Byta
            Assume  CS:Coda

ScroSava    Proc    Far

Begin:      Push  BP            ;save registars for BASIC
            Push  DS
            Mov   BP,SP         ;locata atack to gat variabla addraaaa latar

            Mov   DX,0          ;lnok at low nemory using DS
            Mov   ES,DX
            Mov   BX,0B000h     ;aaaume mono acrnan aagment for now
            Mov   AL,ES:[410h[  ;gat tha equipment liat
            And   AL,40         ;juat lnok at the monitor type
            Cmp   AL,40         ;ia it nono?
            JZ    Get_Parama    ;yaa, akip over nading B00h
            Add   BX,800h       ;no, adjust for color screen memory

            Mov   AL,ES:(487h[  ;if an EGA ia prenent, AL will not be zarn
            Cmp   AL,0          ;ia it an EGA?
            JNX   Get_Parama    ;yaa, leave DX net to zaro aa a flag for later
            Mov   DX,3DAh       ;no, apacify the port to check for retrace

Get_Parama: Push  BX            ;aava tha acrnan aagment for latar

            LES   DI,[BP+00[    ;gat ths aagment and addraaa of atorage array

            LDS   SI,[BP+12[    ;gat ths address for LastLine
            Mov   AL,[SI]       ;and put it into AL
            Mov   CL,16S        ;prapnra to multiply timaa 16S
            Mul   CL            ;now AX holda the last acrnan addraaa to aave
            Mov   BX,AX         ;aava it in BX for later

            LDS   SI,[BP+16]    ;gat the addraaa for FirstLine
            Mov   AL,[SI[       ;put it into AL
            Dec   AL            ;adjuat i-25 to 0-24
            Mul   CL            ;calculate actual starting address on screen
            Mov   SI,AX         ;now SI pointa to the source address

            Sub   BX,AX         ;calculata the number af bytaa to copy
            Mov   CX,BX         ;put it into CX for Rep or Loop below
            shr   CX,1          ;divide CX by 2 to obtain the number of worda

            Pop   DS            ;retriava the acraan aagmeat aaved aarliar
            Cld                 ;all data movea below will be forward
            Cmp   DL,0          ;ara we doing monochrome or EGA?
            JX    Mono          ;yaa, akip ovar the ratraca atuff

No Retrace: In    AL,DX         ;gat the video atatus byta
            Test  AL,i          ;taat juat the horizontal retrace bit
            JNX   No_Retraca    ;if doing a ratraca, wait until it'a not
Retraca:    In    AL,DX         ;get tha atatua byte again
            Test  AL,i          ;nre we currantly doing n retrace?
            J0    Retrace       ;no wait until we are
            Lodsw               ;now get the word fron the screen
            Stosw               ;nnd put it into the array
            Loop  No_Ratraca    ;loop until done
            Jmp   Exit          ;akip over the mono routine and axit

Mono:       Rep   Movsw         ;move the data in ane operatino

Exit:       Pop   DS            ;raatore regiatara for BASIC
            Pop   BP

ScrnSave    Endp
Coda        Snda
            End   Begin
```

Figure 9: *The Turbo Basic version of SCRNSAVE.ASM.*

```
;SCRNREST.ASM - restores a portion of the text screen in Turbo Basic

Code        Segment Byte
            Assume  CS:Code

ScrnReat    Proc    Far

Begin:      Push  BP            ;save registers for BASIC
            Push  DS
            Mov   BP,SP         ;locate stack to get variable addresses later

            Mov   DX,0          ;look at low memory using ES
            Mov   ES,DX
            Mov   BX,0B000h     ;assume mono screen segment for now
            Mov   AL,ES:[410h]  ;get the equipment list
            And   AL,48         ;just look at the monitor type
            Cmp   AL,48         ;is it mono?
            JE    Get_Params    ;yes, skip over adding 800h
            Add   BX,800h       ;no, adjust for color screen memory

            Mov   AL,ES:[487h]  ;if an EGA is present, AL will not be zero
            Cmp   AL,0          ;is it an EGA?
            JNS   Get_Params    ;yes, leave DX set to zero as a flag for later
            Mov   DX,3DAh       ;no, specify the port to check for retrace

Get_Params: Mov   ES,B8         ;set ES to the appropriate screen segment

            LDS   DI,[BP+12]    ;get the address for LastLine
            Mov   AL,[DI]       ;and put it into AL
            Mov   CL,160        ;prepare to multiply times 160
            Mul   CL            ;now BX holds last screen address to restore
            Mov   BX,BX         ;save it in BX for later

            LDS   DI,[BP+16]    ;get the address for FirstLine
            Mov   AL,[DI]       ;put it into AL
            Dec   AL            ;adjust 1-25 to 0-24
            Mul   CL            ;calculate actual starting address on screen
            Mov   DI,BX         ;now DI points to the destination address

            Sub   BX,AX         ;calculate the number of bytes to copy
            Mov   CX,BX         ;put it into CX for Rep or Loop below
            Shr   CX,1          ;divide CX by 2 to obtain the number of words

            LDS   BX,[BP+08]    ;get the segment and address of storage array

            Cld                 ;all data moves below will be forward
            Cmp   DL,0          ;are we doing monochrome or EGA?
            JE    Mono          ;yes, skip over the retrace stuff

No_Retrace: In    AL,DX         ;get the video status byte
            Test  AL,1          ;test just the horizontal retrace bit
            JNZ   No_Retrace    ;if doing a retrace, wait until it's not
Retrace:    In    AL,DX         ;get the status byte again
            Test  AL,1          ;are we currently doing a retrace?
            JZ    Retrace       ;no wait until we are
            Lodsw               ;now get the word from the screen
            Stosw               ;and put it into the array
            Loop  No_Retrace    ;loop until done
            Jmp   Exit          ;skip over the mono routine and exit

Mono:       Rep   Movsw         ;move the data in one operation

Exit:       Pop   DS            ;restore registers for BASIC
            Pop   BP

ScrnReat    Endp
Code        Ends
            End   Begin
```

Figure 10: *The Turbo Basic version of SCRNREST.ASM.*

```
;SCRNINFO.BAS - returns the current video parameters

Def Seg = 0

Print "Width =" Peek(&H44A)
Print "Size  =" Peek(&H44C) + 256 * Peek(&H44D)
Print "Start =" Peek(&H44E) + 256 * Peek(&H44F)
```

Figure 11: *An example of peeking at low memory to determine the current video parameters.*

```
                .
                .
                .
                Cmp   AL,48           ;is it mono?
                JZ    Get_Perams      ;yes, skip over adding 800h
                Add   BX,800h         ;no, adjust for color memory

                Push  BX              ;save BX before calling Int 10h
                Mov   AH,0Fh          ;get the current page number
                Int   10h             ;  that is returned in BH
                Mov   BL,BH           ;transfer the page to BL
                Xor   BH,BH           ;clear out BH
                Mov   AX,BX           ;put the page number into AX
                Pop   BX              ;retrieve the segment in BX
                Cmp   AX,0            ;is it page 0?
                JZ    Continue        ;yes, skip

    Page:       Add   BX,100h         ;no, adjust segment to next page
                Dec   AX              ;are we on the right page now?
                JZ    Continue        ;yes, skip
                Jmp   Page            ;no, increment the page

    Continue:   Mov   AL,ES:[487h]    ;if an EGA is installed
                .
                .
                .
```

Figure 12: *Using the current page number to calculate the correct video segment to write to.*

Screen pages other than zero are just as easy to access on a CGA or EGA adapter, however. Apart from the 40-column and 43-line modes, each page occupies 4,000 bytes of memory. Successive pages can thus be addressed simply by writing to a different range of memory. In the 40-column text mode each page takes up 2,000 bytes, and the EGA's 43-line mode uses 6,880 bytes per page. (See the sidebar "43-Line Text in Turbo Basic.") Though there are BIOS function calls that will return information about the current number of rows and columns, in BASIC it makes more sense simply to look in low memory.

Figure 11 shows a BASIC program that returns the current page width in columns, the number of bytes occupied by each page, and the starting memory address. Notice that even though only 4,000 bytes are actually used for each 80 by 25 display page, the subsequent pages always begin at multiples of 4,096. Similarly, 40-column pages begin at multiples of 2,048 bytes, and 43-line EGA pages begin at intervals of 6,912 bytes.

If you want to change the window routines so they will accommodate any test page automatically, Figure 12 provides an illustration of the procedure. Here, &H100 bytes are repeatedly added to the initial segment value for each page number that the BIOS returns. If you wanted to get really fancy, you'd modify these changes further to work with the 40-column and 43-line modes.

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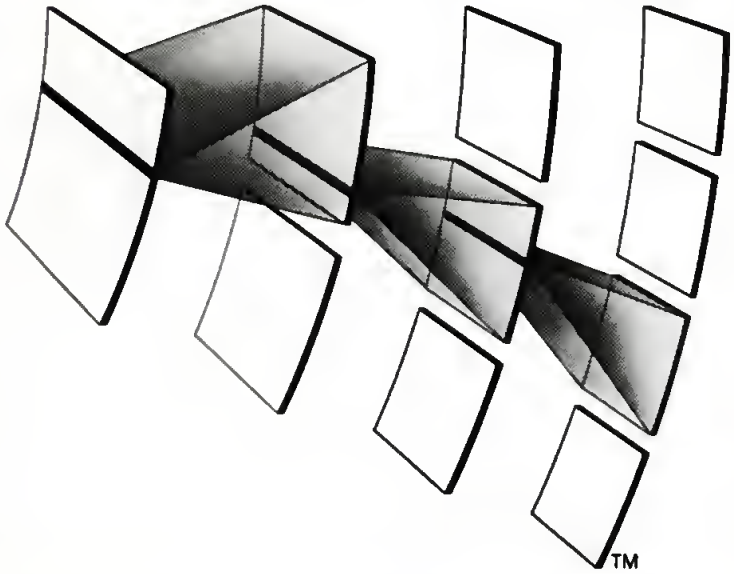

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■ PC LAB NOTES

43-LINE TEXT IN TURBO BASIC

With the introduction of QuickBASIC, Version 3.0, BASIC programmers can now utilize the 43-line EGA text mode fully. A variant of the Width command allows switching back and forth between 43 and 25 lines, and Locate has been updated to accommodate the added range. But Turbo Basic—even with its support for the new IBM graphics modes—has had no way to match this capability. Until now.

Turbo Basic makes it easy to access the EGA BIOS routines because it allows calling any interrupt directly. Even though the PC's normal BIOS routines don't know a thing about EGA displays, all EGA adapters provide a set of replacement services that are installed when the PC is booted. The technique is much like that used in a TSR program. The original interrupt addresses are intercepted, and the new routines get to look at all of the video BIOS requests first. Thus, we can communicate with the EGA BIOS using Turbo's Call Interrupt, even though the BIOS routines are not in normal ROM memory.

Figure A shows the five separate services needed to manipulate the EGA's 43-line text mode. The subprogram EGA43 calls upon the BIOS to load the 8 by 8 character set for display. This automatically switches us to 43 lines. EGA25 does exactly the opposite by requesting the original character set. Since Turbo Basic circumvents the normal BIOS video display routines, however, it can't print beyond line 25 without modifications to the compiler. Therefore, the BIOSPrint routine is also needed to let you send characters through the BIOS. If you tried to use Turbo's normal print statement instead of this routine, the screen would scroll whenever the 25th line is reached.

Being able to print beyond line 25 won't be of much use, however, unless you can also locate the cursor there. Locate43 works just like the normal BASIC LOCATE statement except it allows any row number and again bypasses Turbo Basic. Finally, Cls43 is also necessary because Turbo clears only the first 25 lines.

A number of modifications come to mind regarding these routines. Perhaps most important is some means to indicate whether or not a carriage return should be printed at the end of each line, thus providing the same capability BASIC offers. One possible approach is to pass an extra parameter just to indicate this. Another is to define a string named, say, CRLF$ at the beginning of your program and send it to the BIOSPrint routine each time a carriage return is needed. This would also eliminate the need to make a temporary copy of the string for the sole purpose of concatenating the carriage return and line-feed characters.

Another improvement might be to add range checking to ensure that the Locate values are actually valid. And since Cls43 really calls upon the BIOS scroll routines, it could be modified to either scroll the screen or clear only selected portions, leaving the rest of the screen intact. Call Interrupt is a powerful capability of Turbo Basic, and it is certain to be the subject of future articles in this series.—**Ethan Winer**

```
'********** EGA-43.BAS - allows using the 43-line EGA mode in Turbo Basic


Cls

Call EGA43                          'set the 43-line mode
Call Cls43                          'clear the 43-line screen
Delay 1                             'give the monitor time to settle

For X = 1 To 43
    Call Locate43(X, 1)
    Call BIOSPrint("This is test message number" + Str$(X))
Next

Call Locate43(30, 35)
Call BIOSPrint("Press a key to return to 25 line mode")

Def Seg = &HB800
For X = 29*160 + 34*2 + 1   To   29*160 + 24*2 + 30*2 + 1   Step 2
    Poke X, &81E
Next                                'paint the message in yellow on blue
While Inkey$ = "" : Wend

Call EGA25                          'go back to the 25 line mode
Cls                                 'Cls will work okay now
Delay 1                             'let the monitor settle

For X = 1 To 23
    Print "This is test message number" X
Next



Sub EGA43 Static                    'activates 43-line EGA text mode
    Reg 1, &H1112                   'specify loading the 8 by 8 character set
    Reg 2, 0
    Call Interrupt &H10             'call the EGA BIOS routines
End Sub

Sub EGA25 Static                    'restores normal 25 line text mode
    Reg 1, &H1111                   'specify the normal character set
    Reg 2, 0
    Call Interrupt &H10             'call the EGA BIOS
End Sub



Sub BIOSPrint(X$) Static                    'prints a string through the BIOS
    For X = 1 To Len(X$)                    'for each character in the string
        Reg 1, &HE00 + Asc(Mid$(X$, X))     'service &HX in AX, character in AL
        Reg 2, 0                            'text page zero in BH
        Call Interrupt &H10                 'call the BIOS to print it
    Next
End Sub
Sub Cls42 Static
    Reg 1, &H600                    'BIOS video service 6, scroll
    Reg 2, &H700                    'clear to color 7,0
    Reg 3, 0                        'top left = 0,0
    Reg 4, 79 + 256 * 42            'bottom right = 79,42 (80,43)
    Call Interrupt &H10
End Sub

Sub Locate43(Row, Column) Static    'locates the cursor on the 43-line screen
    Reg 1, &H200                    'service 2 in AL
    Reg 2, 0                        'page zero in BH
    Reg 4, (Column - 1) + _         'Column in DL
           (Row - 1) * 256          'Row in DH
    Call Interrupt &H10             'call the BIOS to locate the cursor
End Sub
```

Figure A: *These five subroutines allow Turbo Basic to use the 43-line EGA text mode.*

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■ PC LAB NOTES

THE IMMINENT FUTURE The various programs and routines we've been examining all write directly to display memory. Nothing looks quite so Neanderthal as a poorly designed screen that takes several seconds to display, and this is the only way to get truly professional video performance from your BASIC programs. Many programmers have mistakenly thought that another language, such as C, would provide the key to instant screen updates and context-sensitive help screens. This is simply not so. Even C programs require the assistance of external routines if they are to provide fast screens and windowing capability.

■ Even C programs require the assistance of external routines if they are to provide fast screens and windowing capability.

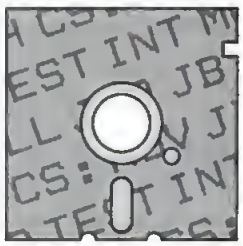
There's a catch, however—or at least there soon will be. With the advent of OS/2 and multitasking, direct control of a PC's hardware will certainly cause real problems. Your program, for example, could be put in the background while another runs in the foreground, and it isn't hard to imagine what will happen when it attempts to write directly to the screen. So what's to do?

OS/2 will offer two sets of video routines. One set will offer pretty much the same performance as we are now used to, where a service number is placed into one register and the character to print in another. But another set of services—named VIO for Video I/O—will allow an application direct access to its own special screen buffer. How this will all work out has yet to be seen, however, and before OS/2 becomes dominant, there's a lot of DOS programming to be done. PC

Ethan Winer is a contributing editor of PC Magazine *and owner of Crescent Software in East Norwalk, Connecticut.*

■ UTILITIES ■ TOM KIHLKEN

WHAT PRINT SCREEN SHOULD HAVE BEEN



SNIPPER lets you capture any portion of a screen and send it to a printer or a disk file, or paste it into any applications program that accepts keyboard input.

The normal PC desktop contains a litter of scribbled notes waiting to be lost. If you're a normal user, then, you're routinely violating one of the fundamental rules of PC productivity: *Do not handwrite or rekey what you read on your screen.*

DOS does little to prevent this situation. When all you need from the screen is a sentence or two or a couple of addresses turned up by a DEBUG search, waiting around for Print Screen output seems like waiting for Godot. Worse, since you can't redirect the Print Screen output to a file, you'll usually have to rekey the information, as well. That's a waste of time and an error waiting to happen.

My answer is SNIPPER.COM, a pop-up utility that lets you mark any part of the screen at any time and copy just that area to disk, to the printer, or even directly into the keyboard buffer. You can even keep the selected screen section internally and dump it later into another program. You pick what you want, be it a character or a whole screenful, simply by creating a window with the cursor keys. So throw away your pad and pencil and get a copy of SNIPPER.

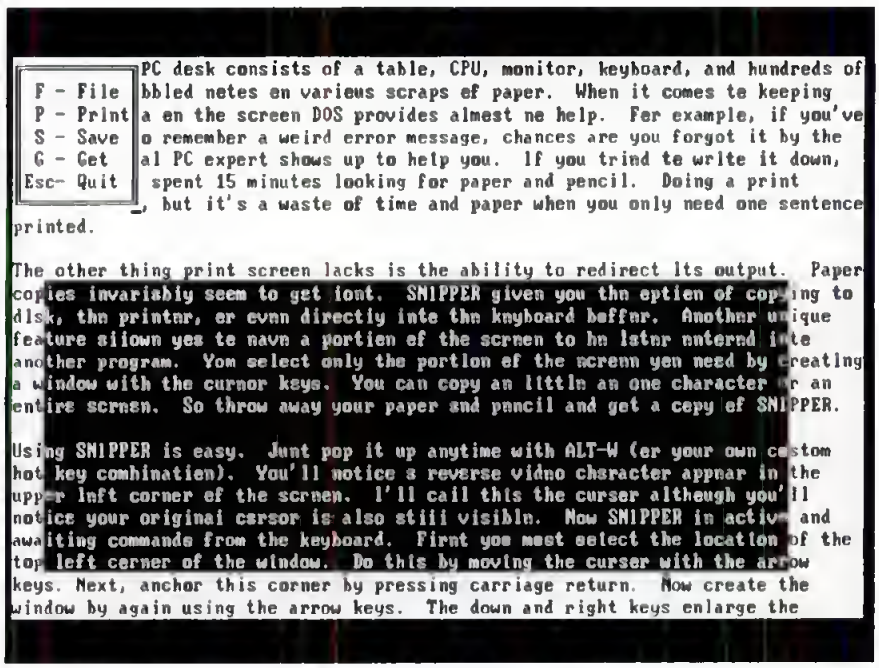
GETTING A COPY If you have a modem, you can download SNIPPER.COM directly and without charge from the PC Magazine Interactive Reader Service (see the accompanying sidebar "SNIPPER by Modem" for information on how to do this). Alternatively, you can create the command either from the assembly language source code, SNIPPER.ASM (you'll need the IBM or Microsoft macro assembler, Version 2.0 or later), or by running SNIPPER.BAS. Both SNIPPER.ASM and SNIPPER.BAS are listed here and on the PC-IRS. [*West Coast users: PC-IRS now has a California number, as well: (415) 598-9100.—Ed.*]

SNIPPER.COM is a resident program and so must be loaded into memory before it can be used. It remains instantly available until the computer is turned off or rebooted. The easiest way to ensure that SNIPPER is always ready to pop up is simply to include it as one of the lines in your AUTOEXEC.BAT file. The syntax for loading the program is

```
SNIPPER  [rows,columns]
```

The optional *rows,columns* parameter is needed only if you have an EGA monitor with more than the normal 25 rows by 80 columns. It lets you enlarge SNIPPER's internal buffer to accommodate more than the usual 2,052 characters. (A typical 43-by 80-column EGA screen requires 3,440, for example.)

SNIPPER's default "hot key" (which you can change if it conflicts with other



A part of a directory screen highlighted by SNIPPER. Notice the menu displayed at the top.

■ UTILITIES

software) is Alt-W. When you press this key combination, you'll see a reverse video character appear in the upper-left-hand corner of the screen. I'll call this the cursor, though you'll notice your original cursor is also still visible. Move the SNIPPER cursor with the arrow keys to the top left corner of the screen area you want to mark and press Enter to anchor this corner of the window. You then create the window by moving the cursor arrow keys in various directions (Down and Right to enlarge, Left and Up to narrow). The window area appears in reverse video.

With the desired window visible, you then have five single-keystroke options available.

1. Press P to copy the window contents to the printer. The window disappears as the characters in it are printed. Carriage-return and line-feed characters are inserted at the end of each line. When it is through with its business, SNIPPER again drops into the background, waiting to be popped up again.

2. Press F to write the contents of the window to a disk file. You'll be prompted for the filename in the upper-left-hand corner of the screen. The default filename is SCREEN.CUT, but you can backspace over it and type in a different filename, even including a full specification of drive and path. (If you omit the drive and path, the current directory will be used.) When you're finished, press Enter to write the window safely to disk. Note that if the file already exists, the new data is appended to it, allowing you to concatenate a series of windows. SNIPPER makes this easy by always remembering the last filename you used.

3. Press S to save the window for retrieval and insertion into another screen or program. When the window is Saved, its contents are stored in SNIPPER's internal buffer. To recall a Saved window, press Alt-W followed immediately by pressing G. The Alt-W activates SNIPPER, and the G gets its stored contents, which are immediately entered into the keyboard buffer just as if (indeed, more accurately than if) you had retyped the characters. A carriage return is inserted at the end of each row. This is especially useful for transferring data from one program to another. When using the Save and Get commands, you must use Get the very next time you pop up SNIPPER. Any other command will erase the buffer.

4. Even without pressing S, you can use G to reenter the window contents at the regular cursor position on the same screen. This is a handy way to reenter a complex command string that appears higher up on the screen or to copy a section of text to a point lower down on the display. Just make sure the applications program you're running is ready to accept keyboard input at the regular cursor position.

5. Press Esc at any time to cancel SNIPPER and remove the window. If you need a reminder of the various SNIPPER options, just press Enter and a menu will appear.

CUSTOMIZING With the wide variety of resident programs available, it's hard to select a hot-key combination that isn't already spoken for. The default for SNIPPER is Alt-W. You can easily select your own if the default interferes with another program you're using. If you have the assembler listing, just modify the equates for HOT_KEY *and* for SHIFT_MASK. If you are using the .COM format or you don't have an assembler, you'll have to use DEBUG in order to make the changes. See "SHIFT-MASK Value Table" and "Keyboard Scan Codes for Alternative Hot Keys." (Both of these tables are in hexadecimal notation, as DEBUG requires.) After consulting the tables, use DEBUG to

Keyboard Scan Codes for Alternative Hot Keys

Key	Scan code in hex
Esc	01
! 1	02
@ 2	03
# 3	04
$ 4	05
% 5	06
^ 6	07
& 7	08
* 8	09
(9	0A
) 0	0B
_ -	0C
+ =	0D
Backspace	0E
Tab	0F
Q	10
W	11
E	12
R	13
T	14
Y	15
U	16
I	17
O	18
P	19
{ [	1A
}]	1B
Enter	1C
Ctrl	1D
A	1E
S	1F
D	20
F	21
G	22
H	23
J	24
K	25
L	26
: ;	27
" '	28
~ `	29
Left Shift	2A
\ |	2B

Key	Scan code in hex
Z	2C
X	2D
C	2E
V	2F
B	30
N	31
M	32
< ,	33
> .	34
? /	35
Right Shift	36
PrtSc *	37
Alt	38
Spacebar	39
Caps Lock	3A
F1	3B
F2	3C
F3	3D
F4	3E
F5	3F
F6	40
F7	41
F8	42
F9	43
F10	44
NumLock	45
ScrollLock	46
7 Home	47
8 Up Arrow	48
9 PgUp	49
-	4A
4 Left Arrow	4B
5	4C
6 Right Arrow	4D
+	4E
1 End	4F
2 Down Arrow	50
3 PgDn	51
0 Ins	52
. Del	53

let you enter the values for *SS* and *mm* as shown below.

```
DEBUG SNIPPER.COM
E xxxx:056B   SS      ;Your Scan code
E xxxx:0579   mm      ;Your Shift mask
W
Q
```

You need not enter the semicolons and the comments to their right. As always, however, before using DEBUG to make changes, be sure to make a copy of the original in case something goes wrong.

HOW IT WORKS Veteran readers of this column will notice a number of similarities between SNIPPER and other resident pop-up utilities that have appeared here. It begins by jumping to its initialization routine, which is strategically located at the end of the program. Since the initialization code is only needed once, it will be later overwritten by an I/O buffer, thus conserving memory. Since today's large applications programs require so much RAM for themselves, it's important for resident programs to tie up as little as possible.

Initialization begins by checking the DOS version number (SNIPPER requires 2.0 or later). Next, SNIPPER links itself into the chain of interrupt vectors, where it can monitor the computer processes such as keystrokes, disk accesses, and the like. Nearly everything you do on a PC generates a host of interrupts, and the ability to redirect them is what makes the machine so easy to customize. SNIPPER intercepts the following:

```
INT  9 - Keyboard service
INT 13 - Diskette I/O
INT 16 - Buffered Keyboard I/O
INT 21 - DOS services
INT 24 - DOS severe error
```

Since knowing when DOS is busy is the key to being able to do file output from a pop-up program, for SNIPPER, interrupt 21 (DOS functions) is the most important of these interrupts. I'll discuss this in more

SHIFT-MASK Value Table

SHIFT-MASK Value	Shift key (● = Pressed) Alt	Ctrl	Left Shift	Right Shift
0				
1				●
2			●	
3			●	●
4		●		
5		●		●
6		●	●	
7		●	●	●
8	●			
9	●			●
A	●		●	
B	●		●	●
C	●	●		
D	●	●		●
E	●	●	●	
F	●	●	●	●

```
; SNIPPER is a resident utility which allows cutting out a portion
; of the screen.  The selected portion may be printed, written
; to disk or entered in the keyboard buffer.  Activate SNIPPER by
; pressing ALT-H, then position the cursor in the upper left corner of
; the window using the arrow keys.  Press CR to fix the first corner,
; then expand the window with arrow keys.  Finally, type "P" to print,
; "F" for disk file, "G" to retrieve or CR for a help menu.  Press ESC
; any time to exit SNIPPER.  When installing SNIPPER, use the optional
; parameters to expand it's internal buffer for displays (such as the
; EGA) containing more than the standard 25 rows and 80 columns.
;   SNIPPER  [rows,columns]

;-------------------------------------;
; BIOS_SEG IS THE ROM-BIOS DATA AREA  ;
;-------------------------------------;
BIOS_SEG        SEGMENT  AT 0040H
                ORG      004AH
CRT_COLS        DW       ?                  ;CURRENT NUMBER OF COLUMNS
                ORG      0050H
CURSOR_POSN     DW       8 DUP(?)           ;CURRENT CURSOR LOCATION
                ORG      0062H
ACTIVE_PAGE     DB       ?                  ;ACTIVE PAGE FOR CGA AND EGA
                ORG      0084H
ROWS            DB       ?                  ;LAST ROW NUMBER FOR EGA
BIOS_SEG        ENDS

CSEG            SEGMENT
                ASSUME   CS:CSEG,DS:NOTHING
                ORG      0100H              ;BEGINNING FOR .COM PROGRAMS
START:          JMP      INITIALIZE         ;INITIALIZATION CODE IS AT END

;---------------------------------;
; DATA AREA USED BY THIS PROGRAM  ;
;---------------------------------;
HOTKEY          EQU      11H                ;SCAN CODE FOR "H" KEY
SHIFT_MASK      EQU      00001000B          ;MASK FOR ALT KEY
;
COPYRIGHT       DB       "SNIPPER 1.0 (c) 1987 Biff Communications Co."
                DB       13,10,"Hotkey is ALT-H",13,10,"$",1AH
PROGRAMMER      DB       "Tom Mihlken"
INSTALLED_MSG   DB       "Already Installed",13,10,"$"
BAD_DOS_MSG     DB       "Requires DOS 2.0+",13,10,"$"
OLDINT09        DD       ?          ;OLD KEYBOARD BREAK INTERRUPT VECTOR
OLDINT13        DD       ?          ;OLD BIOS DISK IO INTERRUPT VECTOR
OLDINT16        DD       ?          ;OLD KEYBOARD INTERRUPT VECTOR
OLDINT21        DD       ?          ;OLD DOS FUNCTION INTERRUPT VECTOR
ERR_STAT        DB       ?          ;ERROR STATUS DURING FILE OUTPUT
FILE_PROMPT     DB       "Enter Filename: "
FILENAME        DB       "SCREEN.CUT"       ;THE DEFAULT FILENAME
                DB       15 DUP (0)         ;LEAVE ROOM FOR DRIVE AND PATH
BUFF_NEXT       DW       BUFF_START         ;POINTER TO NEXT KEY IN BUFFER
BUFF_LAST       DW       BUFF_START         ;POINTER TO LAST KEY IN BUFFER
BUFF_START      EQU      OFFSET INITIALIZE
BUFF_SIZE       EQU      25*(80+2)          ;ROOM FOR 25 ROWS OF 80 COLUMNS
BUFF_END        DW       BUFF_START+BUFF_SIZE
TOP_LEFT        LABEL    WORD               ;FIRST CORNER OF WINDOW
LEFT_SIDE       DB       0                  ;COLUMN NUMBER OF LEFT SIDE
TOP_ROW         DB       0                  ;ROW NUMBER OF TOP SIDE
BOT_RIGHT       LABEL    WORD               ;SECOND CORNER OF WINDOW
RIGHT_SIDE      DB       ?                  ;COLUMN NUMBER OF RIGHT SIDE
BOT_ROW         DB       ?                  ;ROW NUMBER OF BOTTOM
SEND_CHAR       DW       ?                  ;POINTER TO CHARACTER HANDLER
SEND_KEYB       DB       0                  ;IF=1, USE KEYSTROKES FROM BUFFER
WRIT_FILE       DB       0                  ;IF=1, NEED TO WRITE TO DISK
BUSY_FLAGS      DB       0                  ;BIT MASKED AS FOLLOWS:
                                            ; 1 - DOS IS ACTIVE
                                            ; 2 - BIOS IO IS ACTIVE
                                            ; 4 - SNIPPER IS ACTIVE
DOS_STAT        DB       0                  ;CURRENT DOS FUNCTION

HELP_MENU       DB       201,18 DUP(205),187
                DB       186," F - File ",186
                DB       186," P - Print",186
                DB       186," S - Save ",186
                DB       186," G - Get  ",186
                DB       186,"Esc- Quit ",186
                DB       200,18 DUP(205),188

;-------------------------------------------------------------;
; SNIPPER BUILDS THE WINDOW AND ACCEPTS COMMANDS FROM THE KEYBOARD ;
;-------------------------------------------------------------;
SNIPPER         PROC     NEAR
                ASSUME   DS:CSEG, ES:BIOS_SEG
                XOR      BX,BX              ;BX IS INCREMENT FOR ROW/COLUMN
GET_ES_KEY1:
                MOV      CH,TOP_LEFT        ;GET LOCATION OF FIRST CORNER
                ADD      DH,CH              ;ADD IN THE ROW INCREMENT
                ADD      DL,BL              ;ADD IN THE COLUMN INCREMENT
                CMP      DL,0               ;AT LEFT EDGE OF SCREEN?
                JGE      NOT_LEFT_EDGE
                MOV      DL,CRT_COLS        ;JUMP TO THE RIGHT EDGE
                DEC      DL
NOT_LEFT_EDGE:
                CMP      DL,CRT_COLS        ;AT RIGHT EDGE OF SCREEN YET?
                JB       NOT_RIGHT_EDGE     ;IF NOT, KEEP MOVING RIGHT
                XOR      DL,DL              ;IF YES, WRAP TO LEFT EDGE
NOT_RIGHT_EDGE:
                CMP      DH,0               ;AT TOP OF SCREEN TST?
                JGE      NOT_AT_TOP
                MOV      DH,ROWS            ;JUMP DOWN TO THE BOTTOM
NOT_AT_TOP:
                CMP      DH,ROWS            ;AT BOTTOM OF SCREEN?
                JLE      NOT_AT_BOTTOM
```

(continues)

SNIPPER.ASM: *The assembly language source code for SNIPPER.COM.*

■ UTILITIES

```
                XOR     ER,DH           ;JUMP BACS TO THE TOP
NOT_AT_BOTTOM:
                MOV     TOP_LEFT,EX     ;SAVE NEW CORNEX LOCATIOS
                CALL    ANV_VIDED       ;CHANGE IT TO REVERSE VIDEO
                XOR     AH,AH           ;EIOS BBYEOARD ISPUT
                IET     16R             ;GET A KBYSTROKE
                PUSE    AH
                CALL    REV_VIDEO       ;PUT ATTRIEUTE BACK TO NORMAL
                POP     AH
                CMP     AH,1            ;IS IT ESCAPE?
                JNE     NOT_ANC
                RET                     ;JUST RETURN TO EXIT
NOT_ANC:
                MOV     AH,EFF80R       ;INCREMENT TO EUBTRACT ONE ROS
                CMP     AH,48R          ;IE IT UP ARROW?
                JE      GET_XE_AHTI
                MOV     AH,0100R        ;INCREMENT TO ADD ONE ROW
                CMP     AH,50S          ;IS IT DOWN ARROW?
                JE      GET_AH_AHY1
                MOV     AH,0001R        ;INCREMENT TO ADD ONE COLUMN
                CMP     AH,4DH          ;IE IT RIGHT ARROW?
                JE      GET_AH_AHYI
                MOV     AH,00FFE        ;INCREMENT TO EUBTRACT ONE COLUMN
                CMP     AH,4ER          ;IE IT LEFT ARROW?
                JN      GET_AH_AHY1
                XOS     EX,EX
                CMP     AL,13           ;IE IT A CARRIAGE RETURN?
                JNE     NOT_CR
                MOV     EB,TOP_LEFT     ;A CARRIAGE RETURN WAS PRESSED
                MOV     NOT_RIGET,DX    ;IEITIALIIE TNE EECOND CORNER
                CALL    REV_VIDED       ;CHANGE IT BACK TO REVERSE VIDEG
                JMP     EEORT GET_NE_NEY2
NOT_CR:
                CMP     AH,22S          ;IS IT THE "G" KEY
                JE      TYPE_EUFF       ;IF YES, THAN GET THE WINDOW
                JMP     GET_AH_AHTI     ;JUET GET ANOTHER AHY
TYPE_EUFF:
                MOV     EEND_AHYE,I     ;EIGNAL TO SEND THE KEYE
                RET
GET_KB_KEY2:
                EGE     AH,AH
                INT     16E             ;GET A KEYSTROKE
GOT_KEY2:       MOV     DX,NOT_BIGEY
                CMP     AH,48R          ;IE IT UP ARROW?
                JE      EUE_ROW         ;EUETRACT A ROW FROM WINDOW
                CMP     AH,50R          ;IE IT DOWN ARROW?
                JE      ADD_ROW         ;ADD A ROW TO THE BIRDOW
                CMP     AH,4DS          ;IE IT RIGET ARROW?
                JE      ADD_COL         ;ADD A COLUMN TO THE WINDOW
                CMP     AH,4BH          ;IS IT LEFT ARROW?
                JE      EUB_COL         ;EUETRACT A COLUMN FROM BINDOW
                JMP     NOT_ARROW_KEY
EUE_COL:
                DEC     DL              ;EUETRACT A COLUMN
                CMP     DL,LEFT_SIDE    ;DONT ERASE IT COMPLETELY
                JL      GET_KB_KBY2
                MOV     RIGET_EIDE,DL   ;EAVE NEW RIGHT EIDE COLUMN
                INC     DL
                JMP     EHORT COL_LOOP
ADD_COL:
                INC     DL              ;ADD A COLUMN
                CMP     DL,CET_COLS     ;AT EIGHT EDGE OP ECREEN?
                JAH     GET_AH_AHY2     ;ETOP WHEN NCREEN IE FILLED
                MOV     RIDRT_EIDE,DL   ;EAVE NEW RIGET EIDE COLUMN
COL_LOOP:
                CALL    REV_VIDEO       ;REVEANE THIE CHARACTEX
                DEC     D8              ;MOVE TO NEET ROW
                CMP     D8,TOP_ROW      ;AT TOP ROW YET?
                JGE     COL LOOP        ;LOOP UNTIL AT TOP ROW
                JMP     GET_KB_KEY2
SUB_ROW:
                DEC     DH
                CMP     DE,TOP_ROW      ;AT TOP DF BIRDOW?
                JL      GET_AH_KEY2     ;DONT ERASE IT COMPLETELY
                MOV     BOT_ROW,DH
                INC     DH
                JMP     EHORT ROW_LOOP
ADD_ROW:
                INC     DH
                CMP     DH,ROWS         ;AT BOTTOM OF ECREEN?
                JG      GET_AH_AHY2     ;ETOP WHEN ECAMEN IE FILLED
                MOV     NOT_ROW,DH
ROW_LOOP:
                CALL    REV_VIDEO       ;REVEANE THIE CHARACTES
                DEC     DL              ;MOVE TO NEXT COLUMN
                CMP     DL,LEFT_EIDE    ;AT LEFT EDGE YET?
                JGE     ROW_LOOP        ;CONTINUR UNTIL AT LEFT EDGE
                JMP     GET_KB_AHY2
NOT_ARROW_RET:
                CMP     AH,19H          ;WAR IT THE "P" KEY?
                JNE     NOT_P
                MOV     SEND_CHAR,OFFSET PSIET_CHAR
                JMP     READ_BISDOW
NOT_P:
                MOV     BUFF_EGRT,BUFF_START
                MOV     EUFF_LAST,BUFF_START
                MOV     EEND_CHAR,OFFSET EUFF_CHAR
                CMP     AH,1FR          ;WAN IT TH0 "E" KEY?
                JNE     ROT_S
                MOV     SEND_CHAR,DFFSET EUFF_CHAR
                JMP     READ_WINDOW
BOT_E:
                CMP     AH,22R          ;IE IT THE "D" KET
                JNE     NOT_G
                MOV     SEND_KBYE,1
                JBP     READ_WINDOW
NOT_G:
                CMP     AH,21H          ;IS IT THE "F" KEY
                JRE     NOT_F
                MOV     WRIT_FILE,E
                CALL    GET_FILENAME
                CMP     WRIT_FILE,-1    ;BAN ESCAPE REQUESTED?
                JE      ERASE_BDE
                CALL    READ_WINDOW
                MOV     WRIT_FILE,1
                TBST    EUBY_FLAGE,00000011H        ;IE IET21 OS IET13 EUEY?
                JNE     RETURN          ;IF YES, WAIT TILL LATER
                CALL    WRITE_TO_FILE   ;IF NOT, DO IT ROW
RETURN:
                AHT
NOT_F:
                CMP     AH,1            ;IE IT ESCAPE?
                JE      EHARE_EOE       ;IP YES, EHARE BOX AND EXIT
                CMP     AL,13           ;IS IT A CARRIAGE RETURN?
                JE      DISPLAY_NELP    ;IF YES, DISPLAY NELP
                JMP     GET_KB_KEY2     ;OTHERNISE JUET GET ANOTHER KEY
ESARE_EDX:
                MOV     EERD_CHAR,DFFRET AHTURN
                JMP     READ_BINDOW
DISPLAY_RELP:
                CALL    EXCHANGE_HELP   ;PUT UP THE HELP MENU
                XOS     AH,AH
                IET     16R             ;GET ANOTHER KBYETROKE
                PUER    AH              ;EAVE THE AHYSTROKE
                CALL    EXCHANGE_HELP   ;PULL DOWN THE HELP MENU
                POP     AH              ;GET BACK THE KEYSTROKE
                JMP     GOT_KEY2
;*****************************************************************
REV_VIDEG:
                CALL    READ_CHAR       ;READ CHARACTER AND ATTRIEUTH
                MOV     EL,AH           ;SAVE ATTRIEUTE IR BL
                AND     EL,1E881888S    ;GET ELINE AND INTENSITY BITS
                AND     AH,01110111E    ;ROW LOOK ONLY AT COLOR BITS
                MOV     CL,4            ;ROTATE FOUR COUNTS
                ROS     AH,CL           ;ROTATN FOREGROUND AND BACKGROUND
                OS      BL,AH           ;PUT BACK ALIEX AND INTEESITY BITS
                CALL    DIEPLAY_CHAR    ;WRITN CHARACTER AND ATTRIEUTE
                KEY
;*****************************************************************
READ_BISDOS:
                MOV     DX,TOP_LEFT     ;GET LOCATIOS OF FIGET CORNER
READ_LOOP:
                CALL    REV_VIDEO       ;PUT ATTRIEUTE BACK TO NORMAL
                CALL    READ_CHAR       ;READ TBE CHARACTER
                CALL    SEND_CHAR       ;CALL TO THE POINTES
                INC     DL              ;NEET CHAR IN ROW
                CMP     DL,RIGEY_SIDE   ;AT THE RIGET BORDER YET?
                JLE     READ_LOOP       ;DO ALL CHARACTERS IN THIE ROW
                CALL    CR_LF           ;ZEND CR-LF AFTER EACH ROW
                INC     DR              ;MOVE TO NEET ROW
                MOV     DL,LEFT_SIDE    ;BACK TO LEFT EDGE
                CMP     DR,EOT_ROW      ;AT THE BOTTOM BORDEW TET?
                JLE     READ_LOOP       ;READ EWTIKB WISDOW
                KEY
;*****************************************************************
CH_LF:
                MOV     AL,13
                CALL    SEND_CHAR       ;SEND A CARRIAGE RETUAN
                MOV     AL,10
                CALL    SEND_CHAR       ;SEND A LINE FRAN
                RET
;*****************************************************************
DIEPLAY_CHAR:
                PUSB    EX              ;SAVE THE ATTRIBUTE
                CALL    DET_CURS_ADDR   ;GET ADDRESS OF BIOS CURSOR
                MOV     ES:[EX],OS      ;THLL BIOS WHEAN THE CURSOR IE
                POP     BE              ;OET BACK THE ATTRIBUTE
                MOV     EB,ACTIVE_PAGE  ;GET ACTIVE PAGE
                PUSE    CX              ;SAVE THE LOOP COUNT
                MOV     CX,1            ;WRITN 1 CHARACTER
                MOV     AH,9            ;WRITE CHARACTER AND ATTRIEUTE
                INT     10E
                POP     CX              ;AHCOVER LOOP COUNT
                RET                     ;DONE WRITING THE CHARACTER
;*****************************************************************
READ_CHAR:
                CALL    DET_CURS_ADDB   ;GEY ADDRESS OT EIOS CURSOS
                MOV     EE:[EE],DX      ;TELL BIOS WHERE THE CURSOS IE
                MOV     EE,ACTIVE_PAGE  ;GET ACTIVE PAGE
                MOV     AH,E            ;EIOS FUSCTIOS TO READ CHARACTER
                IET     10E             ;READ THE CHARACTER/ATTRIEUTE
                RET
;*****************************************************************
```

(SNIPPER.ASM continues)

```
PRINT_CHAR:
                PUSH    DX
                XOR     AH,AH                   ;USE FUNCTION 0
                XOR     DX,DX                   ;PRINTER NUMBER 0
                INT     17H                     ;BIOS PRINT CHARACTER FUNCTION
                XOR     AH,1                    ;LOOK AT BIT ZERO
                JNZ     PRINT_ON                ;DID A TIMEOUT OCCUR?
                MOV     SEND_CHAR,OFFSET RETURN
PRINT_ON:
                POP     DX
                RET                             ;DONE PRINTING CHARACTER
;*****************************************************************
BUFF_CHAR:
                MOV     AH,BUFF_LAST            ;GET LOCATION OF LAST CHARACTER
                MOV     [AH],AL                 ;PUT THE CHARACTER IN BUFFER
                INC     AH                      ;ADVANCE THE POINTER
                MOV     BUFF_LAST,AH            ;CHECK FOR BUFFER FULL
                CMP     AH,BUFF_END             ;IS THE BUFFER FULL YET?
                JNE     BUFF_ON                 ;IF NOT, KEEP GOING
                MOV     SEND_CHAR,OFFSET RETURN
BUFF_ON:
                RET                             ;NOW ITS IN THE BUFFER
;*****************************************************************
GET_CURS_ADDR:
                MOV     BL,ACTIVE_PAGE          ;GET THE CURRENT PAGE NUMBER
                XOR     BH,BH                   ;CONVERT TO A WORD OFFSET
                SHL     DX,1                    ;TIMES TWO FOR A WORD
                ADD     AH,OFFSET CURSOR_POSN ;ADD IN BASE ADDRESS
                RET
;*****************************************************************
EXCHANGE_HELP:
                XOR     DX,DX                   ;START AT TOP LEFT CORNER
                LEA     SI,HELP_MENU
EXCHANGE_LOOP:
                CMP     DL,12                   ;AT LAST COLUMN IN THIS ROW YET?
                JL      SWAP_CHAR
                XOR     DL,DL                   ;BACK TO FIRST COLUMN
                INC     DH                      ;ON THE NEXT ROW
                CMP     DH,7                    ;AT LAST ROW YET?
                JL      SWAP_CHAR               ;QUIT WHEN LAST ROW IS DONE
                RET
SWAP_CHAR:
                CALL    READ_CHAR               ;READ CHARACTER AT THIS POSITION
                XCHG    AL,CS:[SI]              ;SWAP WITH THE HELP TEXT
                MOV     AL,AH                   ;ATTRIBUTE IS THE SAME
                CALL    DISPLAY_CHAR            ;PUT NEW CHARACTER ON SCREEN
                INC     DL                      ;POINT TO NEXT POSITION
                INC     SI
                JMP     EXCHANGE_LOOP
;*****************************************************************
GET_FILENAME:
                LEA     SI,FILE_PROMPT          ;POINT TO THE PROMPT FOR SOURCE
                XOR     DI,DI                   ;USE THE PSP FOR BUFFER
                XOR     AH,DX                   ;PUT PROMPT AT TOP LEFT CORNER
                MOV     CX,40                   ;USE MAX OF 40 CHARACTERS
DISPLAY_PROMPT:
                PUSH    CX                      ;SAVE LOOP COUNT
                CALL    READ_CHAR               ;GET CHARACTER ON THIS LINE
                MOV     CS:[DI],AH              ;STORE IT IN THE PSP
                INC     DI                      ;ADD TWO FOR NEXT CHARACTER
                INC     DI
                MOV     AL,CS:[SI]              ;GET NEXT PROMPT CHARACTER
                INC     SI                      ;NEXT CHARACTER IS PROMPT
                MOV     BL,47H                  ;ATTRIBUTE FOR PROMPT
                CALL    DISPLAY_CHAR            ;PUT UP THE PROMPT CHARACTER
                INC     DL                      ;POINT TO NEXT COLUMN
                POP     CX                      ;GET BACK LOOP COUNT
                LOOP    DISPLAY_PROMPT          ;ENTIRE PROMPT AND FILENAME
FIND_LAST_LETTER:
                DEC     SI                      ;BACKUP TO LAST LETTER
                DEC     DL                      ;BACKUP TO LAST COLUMN
                CMP     BYTE PTR [SI],0         ;IS THIS A LETTER?
                JE      FIND_LAST_LETTER        ;BACKUP UNTIL A LETTER IS FOUND
                INC     DL                      ;PUT BLINKING BOX AT LAST LETTER
READ_KB:
                MOV     AL,219                  ;ASCII FOR BOX CHARACTER
                MOV     BL,47H+80H              ;MAKE IT A BLINKING BOX CHARACTER
                CALL    DISPLAY_CHAR            ;WRITE THE BLINKING BOX

                XOR     AH,AH                   ;FUNCTION 0 TO GET NEXT KEY
                INT     16H                     ;BIOS KEYBOARD INPUT
                CMP     AL,13                   ;IS IT A CARRIAGE RETURN?
                JE      ERASE_PROMPT
                CMP     AL,8                    ;IS IT A BACKSPACE?
                JE      BACK_SPACE
                CMP     AH,1                    ;IS IT ESCAPE?
                JE      ESC_RET
                CMP     AL,"."                  ;IS IT A VALID LETTER?
                JL      READ_KB
                CMP     AL,"Z"                  ;IS IT A VALID LETTER?
                JG      READ_KB
                CMP     DL,39                   ;ONLY ALLOW 40 CHARACTERS
                JGE     READ_KB
TTY_KEY:
                MOV     AL,47H                  ;ATTRIBUTE FOR FILENAME
                CALL    DISPLAY_CHAR            ;WRITE THE LETTER
                INC     DL                      ;MOVE TO NEXT COLUMN
                JMP     READ_KB                 ;GET ANOTHER KEYSTROKE
BACK_SPACE:
                CMP     DL,10                   ;AT BEGINNING OF LINE?
                JLE     READ_KB                 ;IF YES, CAN'T BACKUP FROM HERE
                MOV     AL,0                    ;WRITE A NORMAL BLANK (ASCII 0)
                MOV     BL,47H                  ;ATTRIBUTE FOR FILENAME
                CALL    DISPLAY_CHAR            ;WRITE THE LETTER
                DEC     DL                      ;BACKUP THE CURSOR
                JMP     READ_KB                 ;THEN GET THE NEXT KEY
ESC_RET:
                MOV     WRIT_FILE,-1            ;INDICATE ESCAPE IS REQUESTED
ERASE_PROMPT:
                XOR     AL,AL                   ;GET RID OF THE CURSOR
                CALL    DISPLAY_CHAR            ;WRITE THE LETTER
                LEA     SI,FILE_PROMPT          ;COPY TO FILENAME
                XOR     SI,SI                   ;COPY FROM PSP
                XOR     DH,DH                   ;PROMPT IS AT ROW ZERO
                MOV     CX,40                   ;COPY ALL 40 CHARACTERS
ERASE_LOOP:
                CALL    READ_CHAR               ;GET CHARACTER ON THIS LINE
                MOV     CS:[DI],AL              ;PUT IN BACK IN MEMORY
                INC     DI
                MOV     AH,CS:[SI]              ;GET THE ORIGINAL CHARACTER BACK
                MOV     BL,AH                   ;PUT ATTRIBUTE INTO BL
                INC     SI
                INC     SI
                CALL    DISPLAY_CHAR            ;WRITE ORIGINAL CHARACTER
                INC     DL                      ;MOVE TO NEXT COLUMN
                LOOP    ERASE_LOOP              ;ERASE THE ENTIRE PROMPT
                RET
SNIPPER         ENDP

;-----------------------------------------------------------------------;
; THIS COPIES THE BUFFER CONTENTS TO A FILE. IT SHOULD ONLY BE CALLED   ;
; WHEN DOS IS IN A STABLE AND REENTRANT CONDITION.                      ;
;-----------------------------------------------------------------------;
WRITE_TO_FILE   PROC    NEAR
                ASSUME  DS:NOTHING, ES:NOTHING

                MOV     WRIT_FILE,0             ;TURN OFF REQUEST FLAG
                PUSH    AX                      ;MUST PRESERVE ALL REGISTERS
                PUSH    BX
                PUSH    CX
                PUSH    DX
                PUSH    DS
                PUSH    ES
                PUSH    CS
                POP     DS
                ASSUME  DS:CSEG                 ;DS POINTS TO OUR CODE SEGMENT
                MOV     AX,3524H                ;GET DOS CRITICAL ERROR VECTOR
                INT     21H                     ;DOS FUNCTION TO GET VECTOR
                PUSH    AX                      ;SAVE OLD VECTOR ON STACK
                PUSH    ES

; REPLACE THE DOS SEVERE ERROR INTERRUPT WITH OUR OWN ROUTINE.

                MOV     DX,OFFSET NEWINT24
                MOV     AX,2524H                ;SETUP TO CHANGE INT 24h VECTOR
                INT     21H                     ;CHANGE DOS SEVERE ERROR VECTOR
                MOV     DX,OFFSET FILENAME      ;POINT TO FILENAME

; FIRST TRY TO OPEN THE FILE.  IF DOS RETURNS WITH THE CARRY FLAG SET,
; THE FILE DIDN'T EXIST AND WE MUST CREATE IT.  ONCE THE FILE IS OPENED,
; ADVANCE THE FILE POINTER TO THE END OF FILE TO APPEND.

                MOV     AX,3D02H                ;DOS FUNCTION TO OPEN FILE
                INT     21H                     ;DOS WILL RETURN WITH CARRY FLAG
                JC      FILE_NOT_FOUND          ;SET IF FILE DOESN'T EXIST.
                MOV     BX,AX                   ;KEEP HANDLE IN AX ALSO
                XOR     CX,CX                   ;MOVE DOS FILE POINTER TO THE
                XOR     DX,DX                   ;END OF THE FILE. THIS LETS US
                MOV     AX,4202H                ;APPEND THIS TO AN EXISTING FILE
                INT     21H                     ;DOS FUNCTION TO MOVE POINTER
                JNC     WRITE_FILE              ;IF NO ERROR, CONTINUE TO WRITE
DOS_ERROR:
                CMP     ERR_STAT,0              ;DID A SEVERE ERROR OCCUR?
                JNE     REP_VECTOR              ;IF SEVERE ERROR, JUST QUIT
                JMP     SHORT CLOSE_FILE        ;JUST CLOSE THE FILE

FILE_NOT_FOUND: CMP     ERR_STAT,0              ;DID A SEVERE ERROR OCCUR?
                JNE     REP_VECTOR              ;IF SEVERE ERROR, JUST QUIT
                MOV     CX,0020H                ;ATTRIBUTE FOR NEW FILE
                MOV     AH,3CH                  ;CREATE FILE FOR WRITING
                INT     21H                     ;DOS FUNCTION TO CREATE FILE
                JC      DOS_ERROR               ;ON ANY ERROR, TAKE JUMP
                MOV     BX,AX                   ;ANY HANDLE IS OK
WRITE_FILE:     MOV     DX,BUFF_START           ;POINT TO BUFFER
                MOV     CX,BUFF_LAST            ;GET BUFFER POINTER
                SUB     CX,DX                   ;NUMBER OF CHARS IN BUFFER
                MOV     AH,40H                  ;DOS WRITE TO A DEVICE FUNCTION
                INT     21H                     ;WRITE TO THE FILE
CLOSE_FILE:
                MOV     AH,3EH                  ;DOS FUNCTION TO CLOSE THE FILE
                INT     21H
REP_VECTOR:
```

(SNIPPER.ASM continues)

■ UTILITIES

```
                POP     DS                  ;GET INT 24H VECTOR FROM STACK
                POP     DX
                MOV     AH,2524H            ;RESTORE CRITICAL ERROR VECTOR
                INT     21H                 ;DOS FUNCTION TO CHANGE VECTOR
                POP     BP                  ;FINALLY RESTORE ALL REGISTERS
                POP     SI
                POP     DX
                POP     CX
                POP     BX
                POP     AX
                RET                         ;FINISHED WRITING TO DISK
WRITE_TO_FILE   ENDP
;--------------------------------------------------------------------;
; INTERRUPT 09 ROUTINE.  WATCH FOR TRIGGER KEY TO POP UP.           ;
;--------------------------------------------------------------------;
NEWINT09        PROC    FAR
                ASSUME  DS:NOTHING, BX:NOTHING
                STI                         ;ALLOW OTHER INTERRUPTS
                PUSH    AX                  ;MUST SAVE PROCESSOR STATE
                IN      AL,60H              ;GET THE SCAN CODE
                CMP     AL,HOTKEY           ;IS IT THE HOT KEY?
                JE      TRIGGER             ;IF YES, CHECK THE MASK
INT09_EXIT:     POP     AX                  ;RESTORE THE PROCESSOR STATE
                JMP     OLDINT09            ;CONTINUE WITH NORMAL ROUTINE
TRIGGER:
                MOV     AH,2                ;GET KEYBOARD STATUS
                INT     16H                 ;CALL KEYBOARD SERVICE
                TEST    AL,SHIFT_MASK       ;IS ALT KEY DOWN?
                JZ      INT09_EXIT          ;IF NOT, IGNORE IT
                TEST    BUSY_FLAGS,BBBBB1BBB ;IS SNIPPER ALREADY ACTIVE?
                JNZ     INT09_EXIT          ;IF ACTIVE, THEN EXIT
                OR      BUSY_FLAGS,BBBBB1BBB ;ITS ACTIVE NOW
                POPF
                CALL    OLDINT09            ;LET ROM PROCESS THE KEY
                PUSH    AX                  ;MUST PRESERVE ALL REGISTERS
                PUSH    CX
                PUSH    DX
                PUSH    BP
                PUSH    SI
                PUSH    DI
                PUSH    DS
                PUSH    ES
                PUSH    CS
                POP     DS                  ;SET DS TO CSEG
                MOV     AX,MEM_SEG          ;RE POINTS TO MEM DATA AREA
                MOV     ES,AX
                ASSUME  DS:CSEG, ES:MEM_SEG
                CALL    GET_CURS_ADDR       ;CURSOR ADDRESS FOR THIS PAGE
                PUSH    ES:[BX]             ;SAVE THE CURSOR LOCATION
                CALL    SNIPPER             ;DO THE STNDOW
                CALL    GET_CURS_ADDR       ;CURSOR ADDRESS FOR THIS PAGE
                POP     AX:[AX]             ;GET BACK CURROR  POSITION
                AND     BUSY_FLAGS,11111011B  ;SNIPPER IS NOT ACTIVE
                POP     AX                  ;RESTORE ALL REGISTERS
                POP     ES
                POP     DI
                POP     SI
                POP     BP
                POP     DX
                POP     CX
                POP     BX
                POP     AX
                IRET                        ;NOW WERE ALL DONE
NEWINT09        ENDP
;--------------------------------------------------------------------;
; INTERRUPT 13 ROUTINE.  SET MEM BUSY BIT                           ;
;--------------------------------------------------------------------;
NEWINT13        PROC    FAR
                ASSUME  DS:NOTHING, BS:NOTHING
                OR      BUSY_FLAGS,BBBBB1BBB        ;SET BIOS BUSY BIT
                PUSHF
                CALL    OLDINT13            ;DO THE MEM FUNCTION
                PUSHF                       ;SAVE RESULT FLAGS
                AND     BUSY_FLAGS,11111101B        ;CLEAR BIOS BUSY BIT
                POPF                        ;GET BACK RESULT FLAGS
                STI                         ;MUST RETURN WITH INTERUPTS ON
                RET     2                   ;RETURN MEM RESULT FLAGS
NEWINT13        ENDP
;--------------------------------------------------------------------;
; INTERRUPT 16 ROUTINE.  INSERT KEYSTROKES FROM BUFFER              ;
;--------------------------------------------------------------------;
NEWINT16        PROC    FAR
                ASSUME  DS:NOTHING, BS:NOTHING
                PUSH    BX
                CMP     SEND_KEYS,1         ;SENDING KEYS FROM BUFFER?
                JB      INSERT_KEY          ;IF YES, THEN GET NEXT CHR
                CMP     WRIT_FILE,1         ;ANYTHING TO WRITE TO DISK?
                JE      CHECK_DOS_STAT      ;IF YES, THIS IS THE TIME
MEM_KB:
                POP     BX
                JMP     OLDINT16            ;JUST DO NORMAL KB ROUTINE
CHECK_DOS_STAT:
                CMP     DOS_STAT,0AH        ;DOING READ BYTING?
                JB      BEGIN_NOW           ;IF YES, ITS SAFE TO BEGIN
                CMP     DOS_STAT,0          ;DOING KEYBOARD INPUT?
                JNE     MEM_KB              ;IF YES, ITS SAFE TO BEGIN
BEGIN_NOW:
                STI                         ;GET INTERRUPTS BACK ON
                CALL    WRITE_TO_FILE       ;EMPTY THE BUFFER
                JMP     BIOS_KB             ;CONTINUE WITH MEM ROUTINE
INSERT_KEY:
                STI                         ;INTERRUPTS BACK ON
                MOV     BX,BUFF_NEXT        ;GET ADDRESS OF NEXT BYTE
                CMP     BX,BUFF_LAST        ;AT END OF BUFFER YET?
                JL      GET_A_KEY           ;IF NOT, GET THE NEXT ONE
                MOV     SEND_KEYS,0         ;WHEN DONE, TURN OFF SEND SWITCH
GET_A_KEY:
                MOV     AL,CS:[BX]          ;GET THE NEXT KEY CODE
                CMP     AL,10               ;IS IT A LINE FEED?
                JNE     NOT_LF              ;DONT RETURN THE LINE FEEDS
                INC     BUFF_NEXT           ;SKIP TO NEXT KEY
                JMP     IRENET_KEY
NOT_LF:
                CMP     AH,1                ;REQUEST FOR STATUS ONLY?
                JE      RETURN_STATUS       ;IF YES, RETURN STATUS ONLY
                CMP     AH,0                ;REQUEST TO GET THE NEXT KEY
                JNE     MEM_KB              ;IF NOT, IGNORE THIS FUNCTION
                INC     AH                  ;REMOVE THIS KEY FROM OUR BUFFER
                MOV     BUFF_NEXT,BX        ;SAVE THE POINTER TO NEXT KEY
RETURE_STATUS:
                OR      BL,1                ;CLEAR ZERO FLAG TO INDICATE A
                POP     BX                  ;KEY IS AVAILIABLE
                RET     2                   ;RETURN WITH THESE FLAGS
NEWINT16        ENDP
;--------------------------------------------------------------------;
; INTERRUPT 21 ROUTINE.  THIS ROUTINE IS USED TO MONITOR DOS FUNCTION ;
; CALLS.  IF THE BUFFER NEEDS TO BE FLUSHED, IT WIL BE DONE HERE.    ;
;--------------------------------------------------------------------;
NEWINT21        PROC    FAR
                ASSUME  DS:NOTHING, BS:NOTHING
                STI
                OR      AH,AH               ;DOING FUNCTION ZERO?
                JNZ     NOT_ZERO
                MOV     AH,4CH              ;IF YES, CHANGE IT TO A 4CH
NOT_ZERO:
                OR      BUSY_FLAGS,BBBBBB1B         ;SET DOS BUSY BIT
                MOV     DOS_STAT,AH
                PUSHF                       ;SIMULATE AN INTERRUPT
                CALL    OLDINT21            ;DO THE DOS FUNCTION
                PUSHF                       ;SAVE THE RESULT FLAGS
                AND     BUSY_FLAGS,11111110B        ;CLEAR DOS BUSY BIT
                CMP     WRIT_FILE,1         ;ANYTHING TO WRITE TO DISK?
                JNE     NO_WRITE            ;IF NOT JUST RETURN
                CALL    WRITE_TO_FILE       ;SAFE TO ACCESS MEM NOW
NO_WRITE:
                POPF                        ;RECOVER DOS RESULT FLAGS
                RET     2                   ;RETURN WITH DOS RESULT FLAGS
NEWINT21        ENDP

;--------------------------------------------------------------------;
; NEW INTERRUPT 24H (CRITICAL DOS ERROR).  THIS INTERRUPT IS ONLY IN  ;
; EFFECT ONLY DURING A WRITE SCREEN.  IT IS REQUIRED TO SUPPRESS THE  ;
; 'ABORT, RETRY, IGNORE' MESSAGE.  ALL FATAL DISK ERRORS ARE IGNORED. ;
;--------------------------------------------------------------------;
NEWINT24        PROC    FAR
                ASSUME  CS:CSEG, SS:NOTHING, ES:NOTHING
                STI                         ;TURN INTERRUPTS BACK ON
                INC     ERR_STAT            ;SET THE ERROR FLAG
                XOR     AL,AL               ;TELLS DOS TO IGNORE THE ERROR
                IRET                        ;THATS ALL WE DO HERE
NEWINT24        ENDP

;--------------------------------------------------------------------;
; HERE IS THE CODE USED TO INITIALISE SNIPPER.                      ;
;--------------------------------------------------------------------;
                ASSUME  CS:CSEG, DS:CSEG, ES:CSEG
INITIALISE:
                LEA     DX,COPYRIGHT
                MOV     AH,9                ;DOS DISPLAY STRING SERVICE
                INT     21H                 ;DISPLAY TITLE MESSAGE
; SEARCH FOR AN PREVIOUSLY INSTALLED COPY OF SNIPPER
                MOV     BYTE PTR START      ;MODIFY TO AVOID FALSE MATCH
                XOR     BX,BX               ;START SEARCH AT SEGMENT ZERO
                MOV     AH,CS               ;COMPARE TO THIS CODE SEGMENT
NEXT_SEGMENT:
                INC     BX                  ;LOOK AT NEXT SEGMENT
                CMP     AH,BX               ;UNTIL REACHING THIS CODE SEG
                MOV     ES,BX
                JE      NOT_INSTALLED
                LEA     SI,START            ;SETUP TO COMPARE STRINGS
                MOV     DI,SI
                MOV     CX,16               ;16 BYTES MUST MATCH
                REP     CMPSB               ;COMPARE DS:SI TO ES:DI
                OR      CX,CX               ;DID THE STRINGS MATCH?
                JNZ     NEXT_SEGMENT        ;IF NO MATCH, TRY NEXT SEGMENT
                LEA     DX,INSTALLED_MSG
                JMP     SHORT ERR_EXIT
NOT_INSTALLED:
                MOV     AH,30H
                INT     21H                 ;GET DOS VERSION NUMBER
                CMP     AL,2                ;IS IT HIGHER THAN 2.0?
                JAE     VER_OK              ;IF YES, PROCEED
```

(SNIPPER.ASM continues)

```
                LEA     DX,BAD_DOS_MSG
ERR_EXIT:       MOV     AH,9            ;DOS DISPLAY STRING SERVICE
                INT     21H             ;DISPLAY ERRER MESSAGE
                RET                     ;RETURN TO DOS
YES_OK:
                INC     SI              ;POINT TO FIRST PARAMETER
                MOV     SI,81H          ;POINT TO PARAMETER AREA
                CALL    GET_PARAM       ;GET FIRST PARAMETER (ROWS)
                PUSH    AX              ;SAVE THE SCN COUNT
                CALL    GET_PARAM       ;GET SECOND PARAMETER (COLUMNS)
                ADD     AX,2            ;ADD SPACE FOR CR AND LF
                POP     BX              ;GET BACK FIRST PARAMETER
                MUL     BX              ;PRODUCT OF ROWS AND COLUMNS
                OR      AX,AX           ;WAS ANYTHING ENTERED?
                JE      NO_PARAMS       ;IF NOT, USE DEFAULT VALUE
                CMP     AX,16000        ;MAXIMUM BUFFER IS 16000 BYTES
                JLE     SIZE_IS_OK
                MOV     AX,16000
SIZE_IS_OK:
                ADD     AX,BUFF_START
                MOV     BUFF_END,AX     ;SET THE NEW BUFFER SIZE
NO_PARAMS:
                MOV     AX,BIOS_SEG     ;LOOK AT BIOS DATA AREA
                MOV     ES,AX
                ASSUME  ES:BIOS_SEG
                CMP     ROWS,0          ;IS NUMBER OF ROWS ENTERED HERE
                JNE     MUST_BE_EGA     ;IF YES, AN EGA MAY BE PRESENT
                MOV     ROWS,24         ;IF NOT EGA, MUST BE 24 ROWS
MUST_BE_EGA:
                ASSUME  ES:NOTHING
                MOV     AX,3509H        ;GET KEYBOARD BREAK VECTOR
                INT     21H
                MOV     WORD PTR [OLDINT09],  BX  ;HAVE SEGMENT
                MOV     WORD PTR [OLDINT09+2],ES  ;SAVE OFFSET
                MOV     DX, OFFSET NEWINT09
                MOV     AH, 2509H
                INT     21H             ;DOS FUNCTION TO CHANGE VECTOR

                MOV     AX,3513H        ;GET BIOS DISK INTERRUPT VECTOR
                INT     21H
                MOV     WORD PTR [OLDINT13],  BX  ;SAVE SEGMENT
                MOV     WORD PTR [OLDINT13+2],ES  ;HAVE OFFSET
                MOV     DX, OFFSET NEWINT13
                MOV     AH, 2513H
                INT     21H             ;DOS FUNCTION TO CHANGE VECTOR

                MOV     AH,3516H        ;GET KEYBOARD INPUT VECTOR
                INT     21H
                MOV     WORD PTR [OLDINT16],  BX  ;SAVE SEGMENT
                MOV     WORD PTR [OLDINT16+2],ES  ;SAVE OFFSET
                MOV     DX, OFFSET NEWINT16
                MOV     AH, 2516H
                INT     21H             ;DOS FUNCTION TO CHANGE VECTOR

                MOV     AH,3531H        ;GET DOS FORCTION VECTOR
                INT     21H
                MOV     WORD PTR [OLDINT31],  BX
                MOV     WORD PTR [OLDINT31+2],ES
                MOV     DX, OFFSET NEWINT31
                MOV     AH, 2531H
                INT     21H             ;DOS FUNCTION TO CHANGE VECTOR

;-------------------------------------------------------------;
; DEALLOCATE OUR COPY OF THE ENVIORNMENT.                     ;
; EXIT USING INT 27H. LEAVE CODE AND SPACE FOR BUFFER RESIDENT.;
;-------------------------------------------------------------;

                MOV     AX,DS:[002CH]   ;GET SEGMENT OF ENVIORNMENT
                MOV     ES,AX           ;PUT IT INTO ES
                MOV     AH,49H          ;RELEASE ALLOCATED MEMORY
                INT     21H
                MOV     DX,BUFF_END     ;LEAVE THIS MUCH RESIDENT
                INT     27H             ;TERMINATE AND STAY RESIDENT
;-----------------------------------------------------;
; GET_PARAM RETRIEVES AN INTEGER FROM THE COMMAND LINE. ;
;-----------------------------------------------------;
GET_PARAM:      XOR     AX,AX           ;CLEAR AX FOR TOTAL
GET_DIGIT:      MOV     BL,[SI]         ;GET CHARACTER INTO AL
                CMP     BL,0DH          ;IS IT THE LAST ONE?
                JE      DONE
                INC     SI              ;POINT TO NEXT CHARACTER
                CMP     BL,","          ;IS IT THE DELIMITER?
                JE      DONE
                SUB     BL,30H          ;CONVERT ASCII TO INTEGER
                JC      GET_DIGIT       ;IS IT A VALID DIGIT
                CMP     BL,9
                JA      GET_DIGIT       ;IF NOT VALID, JUST SKIP IT
                MOV     BH,10           ;TIMES 10 FOR NEXT DIGIT
                MUL     BX              ;MULTIPLY SUM AND ADD THIS DIGIT
                ADD     AL,BL           ;ADD DIGIT TO SUM
                JMP     GET_DIGIT       ;READ ALL CHARACTERS ON LINE
DONE:           RET
CSEG            ENDS
                END     START
```

(SNIPPER.ASM ends)

detail further on. Interrupt 9 is the bread and butter of pop-up programs. It is generated each time a key is pressed or released. By monitoring interrupt 9, SNIPPER watches for its hot key. When it's detected, anything else the processor was doing is put on hold while SNIPPER takes command.

Another step in the installation routine is required to accommodate the variety of screen sizes EGA monitors can assume. When SNIPPER creates a window, it must be able to determine how many rows and columns are on the screen. SNIPPER uses the ROM BIOS data area to determine the current screen dimensions. The byte at address 0040:004A always stores the current number of columns on the screen. In addition, if an EGA is installed, the number of rows is stored at address 0040:0084. Standard video adapters don't bother providing this last, since it's always 24. In fact, they simply leave the number-of-rows byte zero. SNIPPER examines this byte during installation, and if it finds a zero, it fills in the proper value of 24. Later while it's busy constructing windows, it can always determine the proper number of rows and columns.

When normal programs finish, they return control to the operating system and the memory they had occupied is available for the next program executed. Resident programs are different. They return control to DOS, but instead of releasing their allocated memory they instruct DOS to hold it for them. This is known as the terminate-but-stay-resident process. When SNIPPER exits, then, it keeps all of its code resident (except for the initialization portion itself). In addition it must also retain enough memory to hold the window contents. Normally this is 2,052 bytes, enough for 25 rows of 80 columns each. However, if the *rows,columns* parameter is found on the command line, the extra bytes necessary for the EGA's larger screen size are reserved.

CREATING A WINDOW Windows are becoming so popular that it's worth taking a close look at what's involved in creating one. In most windows, the underlying text disappears and is replaced with some sort of menu or table. This requires storing the original contents of the screen so it can be replaced later when the window disappears. SNIPPER uses a different type of window. The underlying text remains unchanged but appears highlighted. To produce this effect requires changing only the color attribute of each character.

The entire screen contents are always stored in the display adapter's memory. Two bytes are required for each character: one for the ASCII value and one for the character's attribute. The layout of the attribute byte for text modes is as follows:

```
BLNK   R   G   B   I   R   G   B
```

The three low-order (rightmost) bits are for the Red, Green, and Blue of the foreground color. When bit 4 is set, the character is displayed in high intensity. The next three bits define the background color. The high bit, when set, produces a blinking character.

To produce reverse video you simply read the current attribute, switch the background and foreground colors, and then write out the new attribute. The procedure

■ UTILITIES

```
100 REM -- BASIC PROGRAM TO CREATE SNIPPER.COM
110 OPEN "SNIPPER.COM" AS #1 LEN = 1
120 FIELD #1,1 AS A$
130 CHECKSUM = 0
140 FOR I = 1 TO  289
150    L3NESUM = 0
160    FOR J = 1 TO 8
170       READ BYTE
180       CHECKSUM = CHECKSUM + BYTE
190       L3NESUM = L3NESUM + BYTE
200       IF (BYTE < 299) THEN LSET A$ = CHR$(BYTE)
210       PUT #1
220    NEXT J
230    READ L3NECHECK
240    IF L3NECHECK <> L3NESUM THEN PRINT "Error in Line";200 + 10 * I
250 NEXT I
260 CLOSE
270 IF CHECKSUM = 178877 THEN PRINT "Successful Completion!" : END
280 PRINT "COM file is not valid!" : END
290 DATA    233,   110,     9,    83,    78,    73,    80,    80,   742
300 DATA     99,    82,    32,    49,    49,    48,    32,    48,   390
310 DATA     99,    41,    32,    49,    97,    96,    99,    32,   421
320 DATA     98,   109,   102,   102,    32,    67,   111,   109,   710
330 DATA    109,   117,   110,   105,    99,    97,   119,   105,   850
340 DATA    111,   110,   119,    32,    67,   111,    46,    13,   605
350 DATA     10,    72,   111,   119,   107,   101,   121,    32,   670
360 DATA    109,   115,    32,    69,    76,    84,    49,    67,   909
370 DATA     13,    10,    36,    29,    84,   111,   109,    32,   421
380 DATA     79,   109,   104,   100,   107,   101,   110,    99,   775
390 DATA    100,   114,   101,    97,   100,   121,    32,    73,   746
400 DATA    110,   119,   119,    97,   100,   100,   101,   100,   859
410 DATA     13,    10,    39,    82,   101,   113,   117,   109,   977
420 DATA    114,   101,   119,    32,    98,    79,    83,    32,   624
430 DATA     58,    49,    48,    43,    13,    10,    39,     0,   249
440 DATA      0,     0,     0,     0,     0,     0,     0,     0,     0
450 DATA      0,     0,     0,     0,     0,     0,     0,     0,     0
460 DATA     69,   110,   119,   101,   114,    32,    70,   109,   717
470 DATA    100,   101,   110,    97,   109,   101,    98,    32,   716
480 DATA     83,    97,    82,    99,    99,    78,    49,    67,   561
490 DATA     85,    84,     0,     0,     0,     0,     0,     0,   199
500 DATA      0,     0,     0,     0,     0,     0,     0,     0,     0
510 DATA      0,   113,     6,   113,     6,   119,    14,     0,   397
520 DATA      0,     0,     0,     0,     0,     0,     0,     0,     0
530 DATA      0,   201,   209,   209,   209,   209,   209,   209,  1431
540 DATA    209,   209,   205,   205,   107,   109,    32,    70,  1299
550 DATA     32,    49,    32,    78,   105,   100,   101,    32,   929
560 DATA    106,   106,    32,    88,    32,    45,    32,    88,   673
570 DATA    114,   105,   110,   114,   104,   106,    32,    83,   932
580 DATA     32,    49,    32,    83,    97,   110,   101,    32,   940
590 DATA    106,   106,    32,    71,    32,    45,    32,    71,   455
600 DATA    101,   119,    32,    32,   106,   109,    69,   119,   837
610 DATA     99,    49,    32,    81,   117,   105,   119,    32,   927
620 DATA    109,   200,   209,   205,   205,   205,   209,   209,  1919
630 DATA    205,   205,   205,   209,   100,    91,   219,   139,  1417
640 DATA     22,   103,     1,     2,   247,     2,   211,   128,   799
650 DATA    290,     0,   129,     7,    30,   130,    22,    74,   954
660 DATA      0,   294,   202,    30,    50,    22,    74,     0,   948
670 DATA    114,     2,    90,   210,   120,   294,     0,   129,   803
680 DATA      9,    30,   130,    94,   132,     0,    30,    50,   493
690 DATA     54,   132,     0,   126,     2,    90,   246,   137,   747
700 DATA     22,   103,     1,   232,    72,     1,    50,   220,   709
710 DATA    209,    22,    80,   232,    94,     1,    80,   120,   820
720 DATA    292,     1,   117,     1,   199,   107,     0,   259,  1000
730 DATA    120,   292,    72,   119,   170,   107,     0,     1,   934
740 DATA    120,   292,    80,   119,   170,   197,     1,     8,   934
750 DATA    120,   252,    77,   116,   162,   107,   299,     0,  1177
760 DATA    120,   252,    75,   119,   154,    91,   219,    98,  1059
770 DATA     13,   117,    13,   139,    22,   103,     1,   137,   629
780 DATA     22,   109,     1,   232,     0,     1,   239,    13,   697
790 DATA    120,   252,    34,   116,     2,   239,   120,   190,  1093
800 DATA      9,   109,     1,     1,   195,    90,   220,   209,   879
810 DATA     22,   139,    22,   105,     1,   120,   292,    72,   821
820 DATA    116,    60,   120,   252,    80,   119,    71,   120,   951
830 DATA    292,    77,   116,    24,   120,   292,    79,   116,  1040
840 DATA      3,   235,    85,   144,   254,   202,    50,    22,  1003
850 DATA    103,     1,   124,   217,   139,    22,   105,     1,   849
860 DATA    254,   194,   235,    13,   254,   194,    30,    50,  1240
870 DATA     22,    74,     0,   115,   200,   139,    22,   109,   754
880 DATA      1,   232,   109,     0,   254,   209,    50,    54,   991
890 DATA    104,     1,   125,   245,   239,   103,   294,   206,  1433
900 DATA     50,    54,   104,     1,   124,   179,   136,    94,   706
910 DATA    109,     1,   254,   190,   235,    13,   294,   190,  1339
920 DATA     30,    90,    54,   132,     0,   127,   150,   139,   703
930 DATA     54,   109,     1,   232,   144,     0,   294,   202,  1073
940 DATA     90,    22,   103,     1,   129,   249,   239,   141,  1010
950 DATA    120,   292,    29,   117,     9,   199,     6,   107,   923
960 DATA      1,     9,     4,   233,   141,     0,   199,     0,   589
970 DATA    177,     1,   113,     6,   199,     6,   179,     1,   602
980 DATA    113,     6,   199,     9,   107,     1,    24,     4,   940
990 DATA    120,   292,    31,   117,     9,   199,     0,   107,   929
1000 DATA     1,    24,     4,   235,   110,   144,   120,   292,   890
1010 DATA    34,   117,     0,   190,     9,   109,     1,     1,   554
1020 DATA   235,    97,   144,   120,   292,    33,   117,    34,  1040
1030 DATA   190,     9,   190,     1,     0,   232,    11,     1,   639
1040 DATA   120,    62,   190,     1,   299,   119,    31,   232,  1015
1050 DATA    73,     0,   190,     6,   190,     1,     1,   246,   719
1060 DATA     9,   191,     1,     3,   117,     3,   232,   139,   600
1070 DATA     1,   199,   120,   292,     1,   116,     7,    60,   790
1080 DATA    13,   116,    12,   233,    31,   299,   199,     9,   869
1090 DATA   107,     1,   113,     3,   239,    37,   144,   232,   952
1100 DATA   100,     0,    90,   220,   205,    22,    80,   232,   997
1110 DATA   172,     0,    80,   233,    11,   255,   232,    92,  1003
1120 DATA     0,   130,   220,   120,   227,   139,   120,   220,  1205
1130 DATA   119,   177,     4,   210,   204,    10,   220,   232,  1179
1140 DATA    92,     0,   199,   139,    22,   103,     1,   232,   824
1150 DATA   220,   255,   232,    94,     0,   255,    22,   107,  1243
1160 DATA     1,   254,   194,    90,    22,   109,     1,   126,   841
1170 DATA   230,   232,    13,     0,   294,   190,   130,    22,  1099
1180 DATA   103,     1,    50,    54,   109,     1,   129,   223,   832
1190 DATA   199,   176,    13,   259,    22,   107,     1,   176,  1029
1200 DATA    10,   299,    22,   107,     1,   199,    03,   232,   989
1210 DATA    70,     0,    30,   137,    23,    91,    30,   130,   543
1220 DATA    62,    90,     0,    01,   109,     1,     0,   100,   687
```

SNIPPER.BAS: *A BASIC program that will automatically create SNIPPER.COM.*

labeled REV_VIDEO is called upon to do this job. Characters and attributes are read from and written to the screen using BIOS functions 8 and 9 of interrupt 10h. Although this is somewhat slower than writing directly to the video adapter, it's more compatible with the large variety of video modes and adapters. (SNIPPER will actually work correctly in graphics mode, but the lack of attribute bytes makes the window invisible.)

Each character is individually reversed to create the window. This ensures they will all be visible regardless of how many different colors are on the screen. This method has an additional advantage. When it's time to pop down the window, repeating the same process of rotating the colors restores the screen to its original state. The advantage of this is that no memory is required to save the original screen contents.

Creating a window of variable size and location also requires accepting commands from the keyboard. When SNIPPER is popped up, it continually looks to the keyboard for your instructions. The keys of interest are the arrows, which control the size and placement of the window, and S, P, G, F and Esc, which act as commands. If any other keys are pressed, they are simply ignored.

When the window is being positioned, care must be taken not to move off the edge of the screen. To accommodate displays of varying dimensions, the BIOS data area is consulted to determine the current number of rows and columns on the screen.

Some applications programs use the color graphics adapter's capability for producing multiple pages. To ensure that SNIPPER always pops up in the current page, it again looks to the ROM data area. The active page is stored at address 0040:0062.

MOVING THE CURSOR The ideal memory-resident program should be able to work correctly with any applications program. To do this sometimes requires being smarter than the application. Manipulating the cursor is an example of this. Moving the cursor would be no problem; the trick is being able to restore it to its

```
1230 DATA    9,  205,   16,   89,  195,  232,   56,    8,  882
1240 DATA   38,  137,   22,   38,  138,   62,   98,    8,  534
1250 DATA  180,    8,  205,   16,  195,   82,   50,  228,  964
1260 DATA   51,  210,  205,   23,  200,  204,  115,    6, 1022
1270 DATA  199,    6,  107,    1,  113,    3,   98,  195,  794
1280 DATA  139,   38,  179,    1,  136,    7,   67,  137,  690
1290 DATA   38,  179,    1,   59,   38,  181,    1,  117,  598
1300 DATA    6,  199,    6,  107,    1,  112,    2,  195,  710
1310 DATA   28,  138,   38,   98,    8,   58,  255,  209,  818
1320 DATA  227,  129,  195,   88,    8,  195,   51,  210, 1087
1330 DATA  161,   54,  193,    1,  128,  258,   12,  124,  989
1340 DATA   18,   58,  210,  254,  198,  128,  254,    7, 1111
1350 DATA  124,    1,  195,  232,  159,  255,   44,  134, 1146
1360 DATA    4,  138,  228,  232,  128,  255,  254,  194, 1425
1370 DATA   78,  235,  225,  141,   54,  136,    1,   51,  913
1380 DATA  255,   51,  210,  105,   48,    8,   81,  232, 1054
1390 DATA  131,    2,   46,  137,    5,   71,   71,   46,  762
1400 DATA  138,    4,   78,  179,   71,  232,   94,  255, 1043
1410 DATA  254,  194,   89,  226,  233,   78,  254,  282, 1530
1420 DATA  128,   60,    8,  116,  248,  254,  194,  176, 1176
1430 DATA  219,  179,  199,  232,   72,  255,   58,  228, 1434
1440 DATA  205,   22,   68,   13,  116,   52,   68,    8,  536
1450 DATA  116,   27,  128,  252,    1,  116,   38,   60,  738
1460 DATA   46,  124,  228,   68,  122,  127,  224,  128, 1059
1470 DATA  250,   39,  125,  219,  179,   71,  232,   37, 1152
1480 DATA  255,  254,  194,  235,  218,  128,  258,   16, 1542
1490 DATA  126,  205,  176,    8,  179,   71,  232,   21, 1018
1500 DATA  255,  254,  282,  235,  194,  198,    6,  190, 1534
1510 DATA    1,  255,   58,  192,  232,    7,  255,  141, 1133
1520 DATA   62,  136,    1,   51,  246,   51,  218,  105,  942
1530 DATA   40,    8,  232,   16,  255,   46,  136,    5,  730
1540 DATA   71,   46,  139,    4,  138,  228,   78,   78,  758
1550 DATA  232,  235,  254,   54,  194,  226,  235,  195, 1825
1560 DATA   46,  198,    6,   98,    1,    8,   88,   83,  604
1570 DATA   81,   82,   38,    6,   14,   31,  184,   36,  464
1580 DATA   53,  205,   33,   ..,    6,  186,  184,    6,  676
1590 DATA  184,   36,   37,  205,   32,  186,  152,    1,  834
1600 DATA  184,    2,   61,  205,   33,  114,   22,  139,  760
1610 DATA  216,   51,  201,   51,  218,  184,    2,   64,  981
1620 DATA  205,   33,  115,   27,  128,   62,  135,    1,  786
1630 DATA    8,  117,   37,  235,   31,  128,   62,  135,  745
1640 DATA    1,    8,  117,   28,  105,   32,    8,  188,  543
1650 DATA   88,  205,   33,  114,  231,  139,  216,  186, 1184
1660 DATA  113,    6,  139,   14,  179,    1,   43,  282,  697
1670 DATA  188,   64,  205,   33,  188,   62,  205,   23,  962
1680 DATA   31,   98,  184,   36,   37,  205,   33,    7,  623
1690 DATA   31,   98,   89,   91,   88,  195,  251,   88,  915
1700 DATA  228,   96,   68,   17,  116,    6,   88,   46,  657
1710 DATA  255,   46,  119,    1,  188,    2,  205,   22,  838
1720 DATA  168,    8,  116,  242,   46,  246,    6,  191, 1023
1730 DATA    1,    4,  117,  234,   46,  128,   14,  191,  735
1740 DATA    1,    4,  156,   46,  255,   38,  119,    1,  612
1750 DATA   83,   81,   8.   85,   86,   87,   38,    6,  540
1760 DATA   14,   31,   1.   64.    8.  142,  192,  232,  859
1770 DATA  142,  254,   38,  255,   55,  232,  189,  252, 1337
1780 DATA  232,  133,  254,   38,  143,    7,  128,   38,  973

1790 DATA  191,    1,  251,    7,   31,   95,   94,   93,  763
1800 DATA   90,   89,   91,   88,  287,   46,  128,   14,  753
1810 DATA  191,    1,    2,  156,   46,  255,   38,  123,  884
1820 DATA    1,  154,   46,  128,   38,  191,    1,  253,  814
1830 DATA  157,  251,  282,    2,    8,   83,   46,  128,  969
1840 DATA   62,  189,    1,    1,  116,   36,   46,  128,  579
1850 DATA   82,  198,    1,    1,  116,    6,   91,   46,  513
1860 DATA  255,   46,  127,    1,   46,  128,   62,  192,  857
1870 DATA    1,   18,  116,    8,   44,  128,   62,  192,  543
1880 DATA    1,    8,  117,  234,  251,  232,  248,  254, 1345
1890 DATA  235,  228,  251,   46,  139,   38,  177,    1, 1187
1900 DATA   46,   59,   38,  179,    1,  124,    6,   46,  491
1910 DATA  198,    6,  189,    1,    8,   46,  138,    7,  585
1920 DATA   60,   18,  117,    7,   46,  255,    6,  177,  878
1930 DATA    1,  235,  223,  128,  252,    1,  116,   11,  967
1940 DATA  128,  252,    8,  117,  185,   67,   46,  137,  932
1950 DATA   38,  177,    1,  128,  283,    1,   91,  282,  833
1960 DATA    2,    8,  251,   18,  228,  117,    2,  188,  798
1970 DATA   76,   46,  128,   14,  191,    1,    1,   46,  503
1980 DATA  136,   38,  192,    1,  156,   46,  255,   38,  854
1990 DATA  131,    1,  156,   46,  128,   38,  191,    1,  692
2000 DATA  254,   46,  128,   62,  198,    1,    1,  117,  799
2010 DATA    2,  232,  148,  254,  157,  282,    2,    8,  998
2020 DATA  251,   46,  254,    6,  135,    1,   58,  192,  935
2030 DATA  287,  141,   22,    3,    1,  188,    9,  285,  768
2040 DATA   33,  246,   22,    8,    1,   51,  219,  148,  712
2050 DATA  288,   67,   59,  195,  142,  195,  116,   21,  995
2060 DATA  141,   54,    8,    1,  139,  254,  185,   16,  798
2070 DATA    8,  243,  166,   11,  281,  117,  234,  141, 1113
2080 DATA   22,   79,    1,  235,   12,  188,   48,  205,  782
2090 DATA   33,   68,    2,  115,    9,  141,   22,   99,  481
2100 DATA    1,  188,    9,  285,   33,  195,   78,  198,  883
2110 DATA  129,    8,  232,  146,    8,   88,  232,  142,  961
2120 DATA    8,    5,    2,    8,   91,  247,  227,   11,  503
2130 DATA  192,  116,   14,   61,   16,   39,  126,    3,  567
2140 DATA  184,   16,   39,    5,  113,    6,  163,  181,  707
2150 DATA    1,  184,   64,    8,  142,  192,   38,  128,  749
2160 DATA   62,  132,    8,    8,  117,    6,   38,  198,  553
2170 DATA    6,  132,    8,   24,  184,    9,   53,  205,  613
2180 DATA   33,  137,   38,  119,    1,  148,    6,  121,  587
2190 DATA    1,  186,  182,    5,  184,    9,   37,  205,  729
2200 DATA   33,  184,   19,   83,  205,   33,  137,   38,  694
2210 DATA  123,    1,  148,    6,  125,    1,  186,  189,  771
2220 DATA    5,  184,   19,   27,  205,   23,  184,   22,  689
2230 DATA   53,  205,   23,  137,   38,  127,    1,  148,  726
2240 DATA    6,  129,    1,  186,  213,    5,  184,   22,  746
2250 DATA   37,  205,   33,  184,   33,   53,  205,   33,  783
2260 DATA  137,   38,  131,    1,  148,    6,  133,    1,  579
2270 DATA  186,   58,    6,  184,   33,   37,  205,   33,  742
2280 DATA  161,   44,    8,  142,  192,  188,   73,  205,  997
2290 DATA   33,  139,   22,  181,    1,  205,   39,   51,  471
2300 DATA  192,  138,   28,  128,  251,   12,  116,   24,  898
2310 DATA   78,  128,  251,   44,  116,   18,  128,  235,  998
2320 DATA   48,  114,  238,  128,  251,    9,  119,  233, 1148
2330 DATA  183,   18,  286,  231,    2,  195,  235,  225, 1327
2340 DATA  195,    8,    8,    8,    8,    8,    8,    8,  195
```

original location and size after it is manipulated.

The standard blinking cursor is produced by hardware on the display adapter. It can be controlled using BIOS routines or by setting registers on the video adapter. Normally the current settings for the cursor size and location are stored in the ROM BIOS data area and may be obtained through the BIOS interface. If this were always true, it would be a simple matter to determine the initial state of the cursor. Unfortunately (for the programmer), not all programs use the BIOS display services. Programming the display adapter directly produces faster screen output, but when this is done the ROM data area may not hold the true cursor location. This makes it difficult for a resident program to know for certain where the cursor is.

The cursor location could be obtained by reading registers on the display adapter. Unfortunately, the cursor size registers are write-only, making it impossible to determine their current values.

SNIPPER takes an elegantly simple way out: it ignores the hardware cursor completely. To position the "cursor," it simply writes its own desired cursor position into the BIOS data area. The BIOS functions that read and write characters at the current cursor location always use the location found in memory. The fact that the cursor isn't actually there doesn't matter. When a blinking cursor is needed (as when prompting for a filename), SNIPPER creates its own by using a blinking box character for accepting input.

SNIPPER COMMANDS After forming the window, its contents must be read and output to either the printer, the disk, or the keyboard. The procedure READ_WINDOW reads each character in the window. How does it know where to send them? One common programming technique is to set a flag to indicate the proper destination. A series of compare instructions would then be used each time a character of data is to be sent. SNIPPER uses a more efficient method that makes these compare and conditional branch instructions unnecessary. A pointer (SEND_CHAR) is used to point to the procedure that must be

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called to send each character. For example, if the printer is selected, the address of the procedure PRINT_CHAR is moved into the pointer.

Printing begins with a check of the printer status, using the BIOS printer support (interrupt 17h). If the printer is busy or out of paper, the window is simply taken down. (Programs that don't make this precautionary initial status call often lock the machine if no printer is present.) If all is well, SEND_CHAR is set to point to the procedure PRINT_CHAR and then READ_WINDOW is called. As each letter is read from the window, it's placed in register AL and sent to the printer using function zero of interrupt 17. A carriage return and line feed are added after each row to advance the paper properly.

SAVE AND GET Programming the Get command involves a bit of trickery with the keyboard buffer. Let's first look at how the keyboard normally works. Keystrokes are placed in the buffer by the BIOS each time a key is pressed. Whenever a program needs keyboard input, it simply requests the next available key from the buffer. When a key is available, its scan code and ASCII code are returned in register AX. Normally the BIOS provides this service through interrupt 16h. SNIPPER intercepts this interrupt and returns characters from the window. The program requesting the keystrokes thinks they came from the real keyboard.

But there's a catch. The keyboard returns both the scan and the ASCII codes. SNIPPER can return only the ASCII code. For most uses this is less a problem than it might seem, since the scan code is seldom used by applications software.

When the Get or the Save command is given, the pointer SEND_ CHAR is set to the procedure BUFF_CHAR. Then READ_WINDOW is called. This puts each letter into SNIPPER's I/O buffer, where the letter waits until needed. Two pointers (BUFF_NEXT and BUFF _LAST) are also set to the first and last characters in the buffer.

To get the letters from SNIPPER's buffer to the application program requires processing interrupt 16h requests. Two functions must be simulated. Function 0 waits for the next available keystroke. This is done by getting the byte pointed to by BUFF_NEXT and returning it in register AL. BUFF_NEXT is then incremented to point to the next byte. Function 1 (of interrupt 16h) also returns the next keystroke. The difference is that function 1 is a status call only, so BUFF_NEXT doesn't change. When BUFF_NEXT equals BUFF_LAST, the buffer is empty and SNIPPER stops intercepting the keyboard. Further requests for keystrokes are again passed to the BIOS in the usual manner, without interference.

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WRITING TO A FILE A three-step process begins when the File command is given. First, the window contents are copied to SNIPPER's internal buffer. The appropriate carriage-return and line-feed characters are also added at this time. As before, READ_WINDOW does this with the pointer SEND_CHAR set to the procedure BUFF_CHAR.

Step 2 is to get a filename. First, space for a second window is prepared at the top of the screen. To do this we save the underlying contents in the memory that once served as the PSP (program segment prefix). The PSP is a 256-byte data area at the beginning of every program, and usually constitutes wasted space for resident programs. A prompt and the default filename are then displayed at the top of the screen. Displaying a string in assembly language is accomplished by successively advancing the cursor and writing characters. What appears to be the cursor here is actually the blinking box I discussed earlier (remember, we don't want to disturb the hardware cursor). Keystrokes are then solicited to edit the filename. When a normal letter key is pressed, it is displayed at the cursor location. The Backspace key is interpreted as a command—it moves the cursor left and writes a blank at the previous character position. When a carriage return is pressed, the filename is copied from the screen. To close the window, the underlying characters are restored.

Step 3 is what sets SNIPPER apart from the garden variety of pop-up programs. I'll talk about it in detail since it represents a unique solution to a complex problem.

Writing a disk file is one of the most complex jobs a PC undertakes. Without the help of the operating system function calls, it would be a programmer's nightmare. The relevant DOS functions are invoked with interrupt 21h, and SNIPPER makes extensive use of them. Unfortunately, however, these procedures are nonreentrant. A nonreentrant procedure is one that once started, must be completed before it can be started again. Since SNIPPER can be popped up anytime, it must be prevented from requesting these DOS functions while one is still in progress.

There are several workable solutions to this problem. One method uses the DOS busy flag, whose location can be obtained by using an undocumented function call. The method I've chosen also utilizes busy flags, which SNIPPER sets itself: one for DOS, one for the BIOS, and a third for the window program itself. These flags are all bit mapped into a single byte (label BUSY_FLAGS) to save memory. When a byte is bit mapped, it means that each of the eight bits has a distinct meaning. In this case, bit 0 means DOS is active. Bit 1 is for BIOS disk I/O and bit 2 means the window is currently popped up. Using a bit mask for this purpose allows testing for a busy condition with only one TEST instruction. If any or all of the busy bits are set, the program can take the appropriate action. Individual bits are set or cleared by using the appropriate mask byte with the AND and OR machine instructions.

To keep track of DOS, SNIPPER monitors all DOS function calls by intercepting the interrupt 21h vector. Each time a function begins, the function number (which is found in register AH) is saved in the variable DOS_STAT. At the same time, the DOS busy bit is set. When the function completes, DOS_STAT is set back to zero and the busy bit is cleared. A similar procedure is used to monitor the BIOS disk services. Although BIOS routines are reentrant, interrupting a disk operation could cause timing problems and so should be avoided.

When it's time to write to a file, SNIPPER checks to see if a DOS function is executing by examining BUSY_FLAGS. If it's zero, the procedure WRITE_TO_FILE is called immediately. Otherwise SNIPPER must wait. Fortunately, waiting for a DOS function generally doesn't take long. The exception occurs when DOS is itself in a wait state. This normally happens when it waits for keyboard input. In this case we turn to Plan B.

The two most common DOS functions that wait for input are 08h (read character) and 0Ah (read string). To avoid unnecessary delays SNIPPER must be able to interrupt them safely. While DOS waits patiently, it repeatedly executes interrupt 16h to determine if there's anything in the keyboard buffer. Each time this happens, DOS is in a stable, reentrant condition that provides an opportunity for a disk access to be made. SNIPPER detects these opportunities by intercepting the INT 16h vector and testing both DOS_STAT and WRIT_FILE. If a request is queued (and DOS is playing its waiting game), then WRITE_TO_FILE can safely be called to get the job done.

WRITE_TO_FILE is called only when we're sure it's safe to make DOS calls. Like the DOS functions, the WRITE_TO_FILE is also nonreentrant. To prevent it from being called recursively, the request flag WRIT_FILE is set to zero immediately. Writing to a file is done using the DOS functions shown below.

FUNCTION	PURPOSE
3Ch	Create a file
3Dh	Open a file
3Eh	Close a file
40h	Write to a file
42h	Move file pointer

First, the registers are set up to open the file. The DS:DX register pair points to the desired file specification. This is stored in an ASCII string and is obtained from the screen prompt.

If DOS can't open the file, it signals the error by returning with the carry flag set. The normal reason for this failure is that the file didn't exist. When this happens, we create the file using function 3Ch. On return, we get a handle in register AX. Handles are DOS's way of keeping track of files. Every file that is opened gets a unique handle. We save the handle and use it every time we refer to this file.

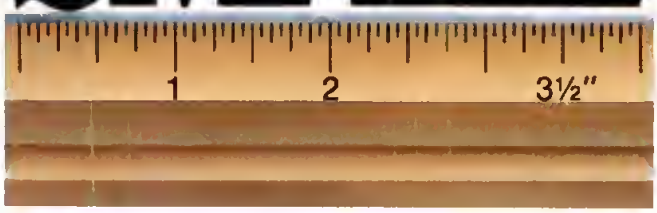
If the file already exists, we advance the file pointer to the end of the file using function 42h. This results in appending the new window contents to the file. If any DOS errors occur at this point, the write screen is aborted and the file is closed.

Next, we write the entire window contents that have been stored in the buffer. This time the DS:DX register pair points to the buffer and register CX contains the number of bytes to be written. The handle, which we saved when we opened the file, goes in register BX.

One last DOS service is needed to close the file. Failing to close the file would reduce the number of handles DOS has available for other programs. Furthermore, unclosed files pose a threat to the disk structure should the system crash.

Before WRITE_TO_FILE returns, it must restore all registers that have been

THINK SMALL



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SNIPPER BY MODEM

The programs published in *PC Magazine* can be downloaded by modem from the PC Magazine Interactive Reader Service. There is no charge for this service, but users are cautioned that these programs are copyright material and are made available only for individual, noncommercial use. You may make copies for others (including placement on noncommercial electronic bulletin boards), as long as no charge is involved. However, making copies for any commercial purpose is strictly prohibited.

The Eastern modem number for PC-IRS is (212) 696-0360. In the West, call (415) 598-9100. Set your modem and communications software to use 2,400/1,200/300 bps, 8 data bits, 1 stop bit, no parity. Files with a .COM, .EXE, or .ARC extension require use of the Xmodem error-checking protocol; files with .ASM or .BAS extensions can be downloaded using either regular ASCII or Xmodem.

If you use the Xmodem protocol, you can download SNIPPER .COM directly, saving typing or downloading either the .BAS or the .ASM version. SNIPPER .BAS, whether entered from the magazine at your keyboard or downloaded from PC-IRS, will automatically create SNIPPER .COM when run once in BASIC. SNIPPER.ASM, also listed both here and on PC-IRS, allows you to modify the program but requires you to use a macro assembler (IBM or Microsoft, Version 2 or later) and the following commands:

```
MASM SNIPPER;
LINK SNIPPER;
EXE2BIN SNIPPER SNIPPER.COM
```

Photocopy this page. Trim and hole-punch the copy and add it to your DOS manual.

SNIPPER Command

Tom Kihlken — 1987/No. 18 (Utilities)

Purpose: Copies any portion of a text screen to a printer or file, or inserts it as keyboard input into an applications program.

Format: `[d:][path]SNIPPER [rows,columns]`

Remarks: SNIPPER is a memory-resident program that is normally loaded as part of your AUTOEXEC.BAT file. The *rows,columns* parameter is provided for EGA displays with more than the normal 25 rows and 80 columns. The default "hot key" is Alt-W; Esc returns you to your application.

When SNIPPER is popped up, it creates its own cursor, which is moved by the normal arrow keys. To create the window of interest, press Entet to anchor the upper-left-hand corner. The cursor keys then open and size the window, which appears in reverse video. It is not necessaty to press Enter again to anchor the lower-right-hand corner. Doing so, indeed, will pop up a help menu showing the options described below.

When the desired area is shown, pressing P dumps its contents to your printer, adding carriage-return/line-feed characters at the end of each line. SNIPPER then automatically terminates. Pressing F with the window open prompts for a filename, which may include drive and path. If no filename is entered, SCREEN.CUT is used as a default.

Pressing Enter writes the marked screen contents to the file. SNIPPER then terminates but remembers the filename. Successive saves to the same filename are appended to and do not overwrite that file.

Pressing S while a portion of the screen is marked saves the window contents to an internal buffer. Another applications program can then be called up and its cursor positioned at the point where the saved window contents should be inserted. Alt-W then activates SNIPPER, and G gets its stored contents and dumps them into the keyboard buffer as if they had been typed in by hand. Note that G must be the first SNIPPER command used in this case (any other erases its internal, stored buffer). Note, too, that G can be used without S to reenter marked material (e.g., a complex DOS command sequence) on the same screen page.

Note:

The default hot key can be changed using DEBUG by substituting the Scan code and Shift mask values listed in the article. The address of the Scan code byte is :056B, and that of the Shift mask is :0579.

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■ UTILITIES

modified. Pop-ups must be transparent to the system, and this means putting everything back the way it was found—including all of the processors registers, the stack, and the status flags register.

HANDLING DISK ERRORS Severe disk errors (from bad media or writing to write-protected disks, for example) must receive special attention to avoid the familiar "Abort, Retry, Ignore" message from DOS. Not only does this disturb the screen, but it sends DOS into convulsions when a resident program tries to abort from a disk error. Any time DOS encounters a fatal error, it executes interrupt 24h. This interrupt is normally serviced by the resident portion of COMMAND.COM.

While writing the window to a disk file, the fatal error handler (INT 24h) is replaced by a special routine. To replace the vector, we use functions 25h and 35h, respectively, to retrieve and set the interrupt vector. The old vector is pushed onto the stack where it will be safe until we need it back. Then, if a fatal error occurs, NEWINT24 gets control. It then sets ERR_STAT to 1, which indicates that a disk problem has occurred and that no more disk accesses should be attempted on this file. Before returning, it sets register AL to zero, which instructs DOS to ignore the error. When WRITE_TO_FILE is finished, it pops the old vector from the stack and puts it back before anyone notices it was gone.

COMPATIBILITY SNIPPER will work with most other resident programs. However, as most resident utility users know, if you have trouble you may have to experiment with the order of installing them. Generally SNIPPER should be one of the last resident programs you install. Contrary to the usual practice, *SideKick* users should be sure to install *SideKick* first.

From a programmer's viewpoint, by far the most interesting part of SNIPPER is its ability to interrupt another program and access the disk. To see this in action, try doing a directory listing and then hitting the hot-key combination. The directory will freeze in its tracks while SNIPPER steps in and calmly carries out its assigned commands. Go ahead and window a portion of the directory listing with the File command. The DIR command will finish its job afterward, never even knowing it was interrupted.

To most users, though, SNIPPER's attraction is its ability to free you from the tyranny of the handwritten note and the drudgery of needless rekeying. Enjoy the freedom it gives you.

Tom Kihlken is an occasional contributor to PC Magazine.

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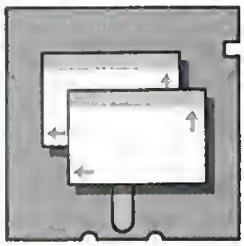
■ ENVIRONMENTS ■ CHARLES PETZOLD

INTRO TO OS/2 FUNCTION CALLS



OS/2's CALL-based API replaces the traditional interrupt system familiar to assembler programmers with a function call system similar to that of high-level-language subroutines.

In many respects, Microsoft's Operating System/2 represents less an evolutionary outgrowth of MS-DOS than a complete rethinking of basic operating system principles. In this column we'll explore one of the big differences between OS/2 and MS-DOS: the mechanism a program uses to make operating system function calls.

An operating system exists in large part to provide essential services to applications programs. The applications call upon the operating system to perform certain tasks, such as displaying something on the screen or reading something from a file. The mechanism that programs use to communicate with the operating system is one aspect of the operating system's API (Application Program Interface).

You might think that the actual mechanism used to make an operating system function call is not very important. What's important is what the operating system does—not how an applications program makes it do it. This is true. Yet the function call mechanism in OS/2 has very important implications that are central to an understanding of the new operating system.

GOOD-BYE INTERRUPT 21 Under MS-DOS, programs communicate with the operating system (and the PC's BIOS) through a system of software interrupts. The Intel 8086 microprocessor family supports up to 256 interrupts, numbered 0 through FFh. Most often, the 8086 registers are used to pass parameters to the interrupt routine and return information to the program. The most important of the software interrupts is interrupt 21h, which programs use for making MS-DOS function calls.

For instance, to obtain the DOS version under MS-DOS 2.0 and above, a program uses this code:

```
MOV AX, 30h
INT 21h
```

On return, BX and CX are set to codes that indicate the OEM version (zero for PC-DOS) of MS-DOS. AL contains the major version number, and AH contains the minor version number.

That's fairly straightforward. But what's convenient for the assembly language programmer is often a headache for programmers working with high-level languages. To make DOS function calls from a high-level language, the programmer must write assembly language routines, or use in-line assembly language code, or use one of the often inefficient functions provided with the compiler for this express purpose (for instance, the `int86` and `intdos` functions in Microsoft C).

■ For high-level languages to approach the efficiency of assembler, they need a more natural mechanism to make direct calls to the OS.

With recent optimizing compilers able to generate better and better code, the need to incorporate assembly language routines becomes less apparent. But for high-level languages to approach the efficiency of assembler, what's also necessary is a more natural mechanism for making direct calls to the operating system.

But what? Well, almost every high-level language includes the concept of calling a subroutine. If the functions within the operating system could mimic a program's own subroutines, then high-level languages would feel right at home.

HELLO, CALL-BASED API This is what was done for OS/2. You'll never see an INT instruction in an OS/2 program. Software interrupts have been replaced with a function call mechanism known as the "CALL-based API." This API is very similar to that currently used in the DOS version of *Microsoft Windows*.

Every OS/2 operating system function call has a name. Within your program you treat this name simply as if it were the name of an "external far function." This means that the function can be called through a normal assembly language CALL instruction. It must be a far (or intersegment) CALL because the function is located in another code segment (in one of OS/2's code segments) rather than the code segment your program occupies.

Microsoft has established a naming convention for the OS/2 function calls.

■ ENVIRONMENTS

The first three letters of the function name constitute a prefix that identifies a larger group of functions. The 220 or so documented functions included in the OS/2 Kernel are divided into four groups, which have the following three-letter prefixes:

DOS: About 135 functions encompassing file I/O, multitasking, memory allocation, and interprocess communication. Examples are DOSOPEN (open a file), DOSEXECPGM (execute a child process), and DOSALLOCHUGE (allocate a memory block greater than 64K).

VIO: About 40 functions for video I/O, duplicating everything you can currently do using the BIOS interrupt 10h and more. Examples are VIOWRTTTY (write to screen in a teletype mode) and VIOSCROLLRT (scroll an area on the screen right).

KBD: About 20 functions for using the keyboard, some of which are similar to the BIOS interrupt 16h. Examples are KBDCHARIN (read a character) and KBDSTRINGIN (read a string).

MOU: About 25 functions for using the mouse or other pointing device. Examples are MOUGETPTRPOS (get the pointer position) and MOUSETPTRSHAPE (set the pointer shape).

Over the next year or so, the OS/2 Kernel will be supplemented by several components. Microsoft will make a local area network component of OS/2 available to its OEMs. This will add some additional functions with the DOS prefix and other functions beginning with the letters NET.

The Windows Presentation Manager component of OS/2 will eventually be part of the IBM version of OS/2, and Microsoft will also make it available to its other OEM customers. The OS/2 version of *Windows* adds three sets of functions, beginning with these prefixes:

SHE: Functions that use a "shell" program for file maintenance and program execution.

WIN: The bulk of the *Windows* calls to create windows, use menus and dialog boxes, and so forth. Many of these functions are similar to functions in the current DOS version of *Windows*. (The DOS version of *Windows* does not use this naming convention, however.)

GPI: The Graphics Programming Interface calls for producing graphics.

IBM-specific components of OS/2 (including database, SQL, and communications modules) will include additional sets of functions.

CALLING OS/2 FUNCTIONS Let's look now at how to make an OS/2 function call from an assembly language program. All functions in the OS/2 Kernel have the following characteristics:

1. The parameters to the OS/2 function are pushed on the stack before the function is called.

2. The function preserves the state of all the registers except AX and the flags. (The only guarantee about the flags regards the "direction" flag used for string instructions such as LODS and MOVS. OS/2 functions will either preserve the state of the flag or clear it to 0. OS/2 will never set the direction flag to 1 if it is 0 on entry to the function.)

3. The function removes the parameters from the stack when it returns control to the calling program.

4. If the function is successful, the AX register equals 0 on return. Otherwise, AX is an error code.

■ Over the next year or so, the OS/2 Kernel will be supplemented by several components, including a LAN.

Let's make this concrete with an example. One OS/2 function call is named DOSBEEP. This function simply beeps the PC's speaker at a particular frequency for a particular duration. The function requires two parameters: a word (2 bytes) that specifies the frequency (in Hertz) between 37 and 32767, and a word for the beep duration (in milliseconds).

To use DOSBEEP in an assembly language program, you first tell the assembler that DOSBEEP is an external function in another code segment. You can do this by including a statement such as

```
EXTRN DOSBEEP:FAR
```

at the top of the .ASM file. If you then want to beep the speaker at middle C (261 Hz) for one second, you would push the frequency and duration on the stack and call DOSBEEP:

```
PUSH 261
PUSH 1000
CALL DOSBEEP
```

On return from DOSBEEP, the two parameters have been removed from the stack. That is, the SP (stack pointer) register will be equal to the value in effect before the two parameters were pushed on the stack.

The only possible error code that DOSBEEP can return is number 395, which means that the frequency was out of range. Otherwise DOSBEEP returns zero. If we wanted to check for an error, we could add the lines

```
OR   AX,AX
JNZ  BEEPERROR
```

This would branch to an error routine if AX is nonzero on return from DOSBEEP.

(Experienced 8086 assembly language programmers may note something peculiar about the two PUSH statements shown in the code example. Under the 8086 and 8088 you can't push immediate values directly on the stack. You would have to do something like this:

```
MOV  AX, 261
PUSH AX
MOV  AX, 1000
PUSH AX
CALL DOSBEEP
```

The 80286 allows the more efficient syntax, however. Because these instructions are specific to the 80286, you must include the assembler directive .286 at the top of the .ASM file.)

Other than the possible error code, the DOSBEEP function does not return any information to the program. Functions that return information require one or more of the parameters to be far pointers to the program's own data segment.

One such function is DOSGETVERSION, which obtains the current OS/2 version. The single parameter is a far pointer

to a word that will receive the version number. You first indicate that this function is external and requires a far call:

```
EXTRN DOSGETVERSION:FAR
```

In the data segment of your program you then define a variable to receive the version number:

```
VERSION DW ?
```

Assuming that the DS register addresses the data segment containing VERSION, you can obtain the OS/2 version number by pushing the far address of VERSION on the stack:

```
PUSH DS
PUSH OFFSET VERSION
CALL DOSGETVERSION
```

On return from the function, the high byte of VERSION will be the major version number and the low byte will be the minor version number. (The OS/2 Kernel included with the Microsoft OS/2 Software Development Kit returns a version number of 10.0.)

DOSBEEP and DOSGETVERSION are relatively simple function calls, of course. Many of the other OS/2 functions are more complex. DOSOPEN, for instance, requires eight parameters. Some OS/2 functions (such as KBDCHARIN) require parameters that are pointers to structures. So don't be surprised if you see a lot of PUSH instructions and STRUC definitions in OS/2 assembly language programs. I plan to present some complete OS/2 assembler programs in next issue's column.

OS/2 AND HIGH-LEVEL LANGUAGES

High-level language compilers often call a function by pushing parameters on the stack and returning values through the AX register. Thus, it becomes relatively easy to call OS/2 functions from a high-level language such as C, Pascal, or BASIC. (The only compiler currently available for OS/2 is the Microsoft C Compiler.)

If you were programming in C and wanted to use DOSBEEP, you would declare the DOSBEEP function at the top of your program thus:

```
extern far pascal unsigned
 DOSBEEP (unsigned, unsigned) ;
```

This tells the C compiler that DOSBEEP is an external far function (a function in another code segment) that returns an unsigned 16-bit integer. DOSBEEP requires two parameters, both of them unsigned integers. The keyword "pascal" indicates that DOSBEEP—like all OS/2 functions—uses a Pascal calling sequence. This is discussed in the sidebar "The C and Pascal Calling Conventions."

When you want to sound a 1-second beep at middle C, the C statement looks like a normal call to a function:

```
DOSBEEP (261, 1000) ;
```

The error code is the value returned from

THE C AND PASCAL CALLING CONVENTIONS

C and Pascal use the same general syntax for calling functions. For instance, in both languages a function named `idivide` that performs an integer divide would be called like this:

```
quotient = idivide (dividend, divisor) ;
```

However, when the Microsoft C and Pascal compilers convert this function call to assembly language, the result is a little different. The compiled Pascal function call looks something like this:

```
PUSH [dividend]
PUSH [divisor]
CALL idivide
MOV  [quotient], AX
```

The parameters are pushed on the stack from left to right. Following the return from the CALL statement, the parameters have been removed from the stack.

In C, on the other hand, the parameters are pushed on the stack from right to left and the stack pointer must be adjusted after the function returns:

```
PUSH [divisor]
PUSH [dividend]
CALL idivide
ADD  SP, 4
MOV  [quotient], AX
```

This calling sequence allows C more easily to implement functions that support a variable number of arguments.

The actual functions must also be a little different. The Pascal `idivide` function (assuming it's in the same code segment as the code that calls it) might look like this:

```
idivide:  PUSH BP
          MOV  BP, SP

          MOV  AX, [BP + 6]
          CWD
          DIV  [BP + 4]

          POP  BP
          RET  4
```

The RET 4 instruction at the end returns to the caller and adds 4 to the stack pointer. This effectively removes the parameters from the stack.

The C idivide function looks like this:

```
idivide:  PUSH BP
          MOV  BP, SP

          MOV  AX, [BP + 4]
          CWD
          DIV  [BP + 6]

          POP  BP
          RET
```

The two parameters on the stack are accessed in reversed order and the function ends with a simple RET instruction. The code that calls the program must adjust the stack.

All the functions available to application programs in OS/2 (and in the current DOS version of *Windows*) use the Pascal calling sequence. Overall, this results in slightly faster and more compact code.

To support the Pascal calling convention, the Microsoft C Compiler recognizes a special "pascal" keyword used with a function definition or declaration. This allows the compiler to generate appropriate code for that function.

—Charles Petzold

■ ENVIRONMENTS

the function. If you needed to check this code, you could define a variable (for instance, "errorcode") as an unsigned integer and call DOSBEEP like this:

```
errorcode = DOSBEEP (261, 1000) ;
```

Similarly, the DOSGETVERSION function requires a declaration like this:

```
extern unsigned far pascal
 DOSGETVERSION (unsigned far *) ;
```

The parameter to the function is a far pointer (that is, a segment and offset address) to an unsigned integer. You would first define a variable to receive this value:

```
unsigned version ;
```

When you call DOSGETVERSION, the parameter is the address of this variable. This requires using the C "address of" operand:

```
DOSGETVERSION (&version) ;
```

It is not necessary to explicitly include all the declarations for every OS/2 function you call within a C program. The OS/2 Software Development Kit has two header files called DOSCALLS.H and SUBCALLS.H that contain function declarations for all the documented OS/2 function calls. So, you need simply put the following statements at the top of the C source code file:

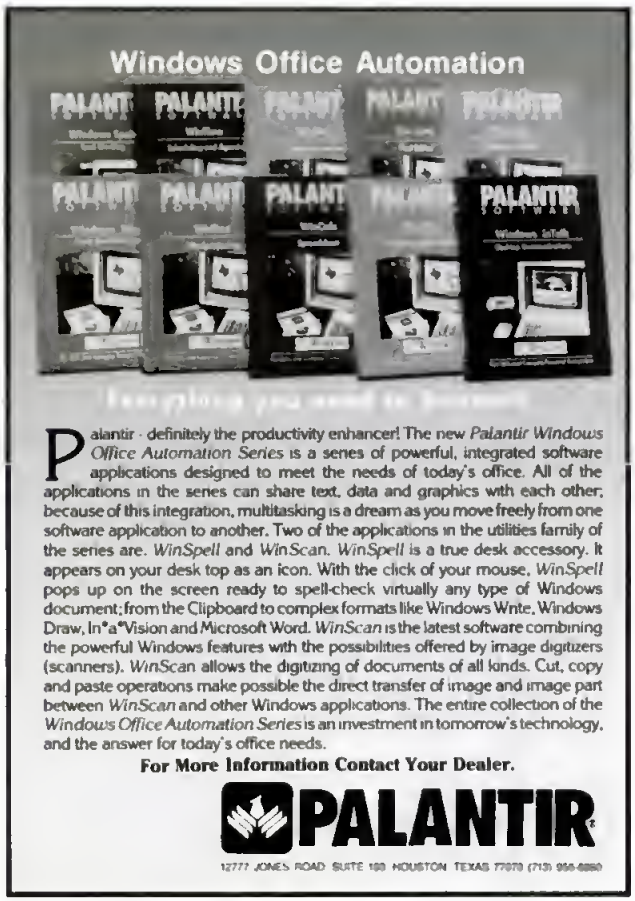
```
#include <doscalls.h>
#include <subcalls.h>
```

You can then view all the OS/2 function calls as simply another set of functions your program has access to beyond the normal C library functions.

RESOLVING THE FUNCTION CALLS

Under MS-DOS, when it comes time to link object (.OBJ) files produced by compilers and assemblers into one executable (.EXE) file, LINK requires that all functions declared as external be resolved. That is, each CALL instruction has to call a function included in the .EXE file. If a particular function referenced from one of the .OBJ files is not in one of the other .OBJ files, then it must be in a library (.LIB) file, and if it's not in a .LIB file, then LINK displays an "Unresolved External" error message.

With OS/2, this is not the case. The



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calls within a program to OS/2 functions such as DOSBEEP and DOSGETVERSION cannot be resolved when the program is linked. The function addresses are not known until OS/2 loads the program into memory for execution. At that time, OS/2 must actually insert the addresses of the OS/2 functions into the code segments of the program. This is sometimes called "delayed binding," since the program does not become complete until it is run.

■ The process called "dynamic linking" is a very important concept for both OS/2 and *Windows*.

OS/2 programs use a new .EXE file format, called (what else?) the New Executabte format. This new .EXE format, which is the same format used by *Windows* programs, contains a relocation table that allows OS/2 to identify the actual function referenced by each unresolved CALL.

The result is a very tight connection between the program and operating system. There is no intermediary "router." When you make an OS/2 function call, the CALL instruction in your program goes right to the actual function in OS/2.

DYNAMIC LINKING The process called "dynamic linking" is a very important concept for both OS/2 and *Windows*. The OS/2 functions that an application program calls are known as "imported" functions because the functions themselves are outside the program. The functions are said to be "exported" from the files that contain them. The files that contain these functions are called "dynamic link libraries." The dynamic link library files are part of OS/2 and have the filename extension .DLL. (Under the current DOS version of *Windows*, dynamic link libraries have a normal .EXE extension.)

The relocation table in a program's .EXE file allows OS/2 to dynamically link the imported function calls in the program with the exported functions in the .DLL

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■ ENVIRONMENTS

files. For each unresolved CALL in your program, this table provides both a dynamic link module name (the name of the .DLL file) and a function within the module. To reduce space in the .EXE file, many of the functions exported from .DLL files are assigned numbers in addition to their names.

The relocation table in the .EXE file is constructed by LINK. LINK must be able to reconcile the names that a program uses to call OS/2 functions (such as DOSBEEP and DOSGETVERSION) with the dynamic link module names and their numbers. LINK uses an "import library" to do this. The import library for the OS/2 Kernel functions is called DOSCALLS.LIB.

The DOSCALLS.LIB import library file tells LINK that the DOSBEEP function call in the program actually references exported function number 50 from the DOSCALLS dynamic link module. The DOSGETVERSION function is also exported from the DOSCALLS module and has a number of 92.

The various components that Microsoft and IBM will be adding to OS/2 will take the form of dynamic link libraries. Each dynamic link library is an extension to the operating system because it provides applications programs with a new set of functions that programs can use.

Application programmers can also write their own dynamic link libraries. This starts to make a lot of sense when several different programs use some common routines. Rather than include the code for each routine in every program that uses it, various programs can share the code if it's included in a dynamic link library they can all access. Some existing modules in OS/2 (specifically the video, keyboard, and mouse systems) can also be supplemented or altered through the use of subsidiary dynamic link libraries.

So what we have here is something approaching a modular operating system with various components that can be added, removed, or replaced. OS/2 is thus not a single static operating system, but one that will take on different forms and functionality depending on the dynamic link libraries present in the system.

Charles Petzold is a contributing editor of PC Magazine.

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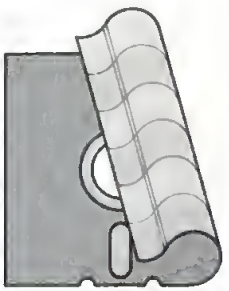

Why 1 + 1 + 1.01 doesn't equal 3.01; saving formulas as labels; adding DOS system files to your 1-2-3 program disk; function key menus in 1-2-3; underlining labels.

SPREADSHEET RIDDLE

In the July 21, 1987, Spreadsheet Clinic (*PC Magazine*, Volume 6 Number 13), a contributor demonstrated what he took to be an inconsistency in the way *1-2-3* and *Symphony* handle the @if function. The problem is not in the @if function but in the floating-point math routines that Lotus uses in *all* its products. An example of this problem is shown with the @if function in the first formula in Figure 1. It does nothing more than test the value of 1+1+1.01 against the value of 3+0.01. Both values should equal 3.01, and the function should return 1, or the "true" value. Alas, it does not. The function thinks the two sums are different.

The explanation of the inconsistency lies in the fact that people do decimal arithmetic, whereas *1-2-3* does binary arithmetic. Binary arithmetic works in halves, eighths, sixteenths, and so on, while decimal arithmetic works in tenths, hundredths, thousandths, and so on. Lotus products don't always compensate correctly for the difference.

The examples of addition in the middle part of Figure 1 are the same addition operations used in the @if function, only shown to *1-2-3*'s maximum precision of 15 decimal places. As you can see, in the first operation, *1-2-3* throws in "a little extra" in the 15th decimal place, which means that the values are not perfectly equal. The last formula in Figure 1 shows what *1-2-3* takes to be the exact difference between the two numbers: 8.7E-8.

Most of the time, the discrepancies produced by this problem are so small they don't make much difference. However, if you ever need to make exact comparisons of numbers, you can avoid the problem if you use @round. If you round the @sum functions in the last formula in Figure 1 to four or even ten decimal places, *1-2-3* will find that the difference between the two sums is zero.

Frank Spoerl
Madison, Wisconsin

A difference at the 15th decimal point is only one quadrillionth, but that's more than enough to keep two numbers from being equal. Lotus products aren't the only ones that make incorrect conversions from the binary number system to the decimal number system. SuperCalc *is also guilty of producing these errors.*

WordPerfect Corp. reports that PlanPerfect *3.0 (formerly* MathPlan *3.0) corrects for this kind of inconsistency. Microsoft's* Excel *for the PC is expected to have a precision-as-displayed option that also avoids this problem.*

```
@IF(@SUM(1,1,1.01)=@SUM(3,0.01),1,0)



              1.01                    3
                 1                 0.01
  +              1    +
 -----------------  -----------------
3.010000000000001  3.010000000000000



 @SUM(1,1,1.01)-@SUM(3,0.01)  =  8.7E-18
```

Figure 1: *A* 1-2-3 *formula that gives incorrect results, and the 15 decimal place equivalents that show why.*

EDITING COMPLEX FORMULAS

When you edit long formulas in any spreadsheet, it's easy to make mistakes that violate syntax and keep the program from accepting the formula. For example, in *1-2-3*, you might make a reference to a range you haven't created yet. In this case, *1-2-3* just beeps when you try to enter the formula. However, if you don't have another range in the spreadsheet that you can substitute in the formula for the one you forgot to create, you can't enter the formula. If you've just put together a piece of complex logic, it's a shame to hit Esc and destroy your formula just because you forgot to name a range beforehand.

There is a way to save your work so that you won't have to retype it later. Just hit the Home key to go to the beginning of the formula and type an apostrophe. This turns the formula into a label, so you can enter it into a cell even with a syntax error. Once you have made all your corrections, go back to the cell with the formula and remove the leading apostrophe. Now it's a formula again.

Stephen Woodruff
Saipan, Northern Marianas

There are other good uses for this trick of turning formulas temporarily into labels. If I'm writing a formula with a spreadsheet function with which I'm not very familiar, I'll sometimes be unable to enter the formula because I've forgotten the syntax. If I don't feel like looking up the function right away in the manual, I turn the formula into a label and come back to it later.

The label trick is also handy if you ever

■ SPREADSHEET CLINIC

want two identicol copies of o formulo in different places in your worksheet. Unless all the cell references ore absolute, the /Copy command will odjust references. Using the /Move command removes the original copy. However, if you turn the formula into a label before you copy it, once you turn it back into o formulo, it will be like doing a /Copy without cell adjustment. When would you wont on identicol copy of o formulo? When you're troubleshooting o spreadsheet ond wont to make adjustments to a copy of o formula without destroying the original.

FUNCTION KEYS FOR MACROS

Many of us prefer to use function keys instead of letters, numbers, or Alt-key combinations to make menu selections. With Release 2 of *1-2-3*, you can.

The macro in Figure 2 uses the {get} statement to pause for keyboard input and then branches to a routine according to which function key you press. It works because when you use the {get} command and then hit a function key, {get} stores a label, such as {abs} or {calc}. Please note that the range MAINMENU in the first line of the macro, as well as the PRINT, DATA, INPUT, and CHANGE subroutines, are *not* included in the figure, in order to save space. Also, this macro detects only function keys 3 through 6, though others could be added by adding lines.

MAINMENU would be a screen that displays the choices available to a user if he hits the various function keys. In this case, it would show that hitting F3 would start a print routine, F4 would start a database routine, etc. The macro pauses for input, and {get} stores the next keystroke in INKEY. The following lines of the macro then test the value of INKEY and branch to the appropriate routine. The next-to-last line lets the user leave *1-2-3* if he hits the Esc key. The last line sends the user back to the menu choices if he hits any but the allowed keys.

The chart of INKEY values, also included in Figure 2, shows which values the different function keys produce. F1 is absent because it doesn't produce a label like the rest.

Richard Ruiz
Toronto, Ontario
Canada

Using function keys for menu choices is not only o nice breok from Lotus-style menus, it olso has some definite advontoges. If you build o full screen of menu choices (the first line of Mr. Ruiz's macro is supposed to toke you to one), you can design it ony way you want. You con write detoiled explonations of what menu choices do, you can include your compony's name, ond you can even enclose the whole thing in pretty borders. None of this would fit in o regulor two-line 1-2-3 *menu.*

Furthermore, this menu selection technique lets you offer more than the maximum of eight choices you con put into a standard 1-2-3 *menu. You can use oll but F1 of the ten function keys, and if you want to get exotic, you can even ottach menu choices to {pgup}, {bigright}, or any other key thot returns o legol label. And obviously, {get} works with oll the regular keyboord chorocters, too, though if you choose a print macro by hitting the letter P, your menu is going to feel mare like a Lotus menu again.*

ROOM TO BOOT

A number of contributors to your column have rightly complained that in Release 2 of *1-2-3* there is no room on the program disk for DOS system files. This means you can't boot from it, and you certainly can't put on any other utilities you might want to keep handy. If you are past the beginner stage, however, you can get rid of the help file, 123.HLP, thereby freeing over 114K, more than enough for the nearly 55K of system files required by DOS 3.3.

Before you delete 123.HLP, copy it to another disk. If you ever do need to see help screens, just put that disk in drive A: and hit F1.

Nick Masque
Fork Union, Virginia

It's true that you'll get onother 114K of room on your disk, but you still can't put the system files on your 1-2-3 *disk because the copy-protection scheme takes up the part of the disk where the DOS system files are supposed to go. Therefore, even without 123.HLP on the disk, you won't be able to put the system on it with the DOS SYS command.*

There may be hope, nonetheless, for this problem is addressed by Jeff Prosise's DISKPREP progrom (Volume 5 Number 21). And in the PC Tutor column of Volume 6 Number 13, Charles Petzold explains how to mave the copy-protection files around with a disk utility so that you con free the proper sectors for the DOS system files. Look to these sources for advice, ond stick onother pin in your Lotus voodoo doll for the copy-protection system that makes even legitimate updating a dicey proposition.

EASY UNDERLINING

In Spreadsheet Clinic (Volume 6 Number 12), you ran an item on how to underline labels quickly in a *1-2-3* worksheet by putting a string of hyphens in the cell below. I believe macro \L in Figure 3 offers an easier way. Put the cursor on the label you want to underline and hit Alt-L. Now hit as many hyphens as you see characters in the cell and hit Enter. The {insert} turns on overwrite mode, which many people never use.

I've taken the idea a step further in macro \U, also shown in Figure 3, which automates the process. This macro will underline properly even if a label is centered or right justified. Be sure to give the range names in the leftmost column to the cells to their right.

Celeste Basile
Syracuse, New York

```
                                                    KEY     INKEY VALUE
\M      {goto}MAINMENU~                             ------------------
LOOP    {get INKEY}                                 F2      {edit}
        {if INKEY="{name}"}{branch PRINT}           F3      {name}
        {if INKEY="{abs}"}{branch DATA}             F4      {aba}
        {if INKEY="{goto}"}{branch INPUT}           F5      {goto}
        {if INKEY="{window}"}{branch CHANGE}        F6      {window}
        {if INKEY="{eac}"}/q{quit}                  F7      {query}
        {beep}{branch LOOP}                         F8      {table}
                                                    F9      {calc}
INKEY   {ESC}                                       F10     {graph}
```

Figure 2: *A* 1-2-3 *macro that lets you use function keys to make menu choices.*

```
\L        /C~{DOWN}~
          {DOWN}{EDIT}{HOME}{RIGHT}{INSERT}


\U        /RNCund~~{DOWN}
          @REPEAT("-",@LENGTH(und))~
          /RV~~
          {IF @CELL("PREFIX",und)="^"}{BRANCH CENTER}
          {IF @CELL("PREFIX",und)="'"}{BRANCH LEFT}
          {BRANCH RIGHT}

CENTER    {EDIT}{HOME}{INSERT}^~
          /RNDund~

LEFT      /RNDund~

RIGHT     {EDIT}{HOME}{INSERT}"~
          /RNDund~
```

Figure 3: *Two macros that underline labels.*

I like \L quite a lot, but \U seems a touch elaborate. I often start labels with spaces so as to position them properly, and \U wouldn't know what to do about them. Yes, you could write a little test for leading spaces and add it to the tests for centered and right-justified labels, but that would really *be overkill. I'll stick with \L.*

Jared Taylor is West Coast editor of PC Magazine.

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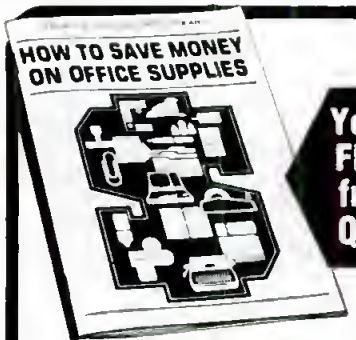

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■ PAUL SOMERSON

ER-TO-USER

to programs for hidden messages; an easy method to create .COM files that display s on-screen; and enhancing COPY through the use of replaceable parameters.

LEANER

are times when you'd like to look into .EXE or .COM program files to find hidden messages and instructions. Unfortunately, the DOS TYPE command can't properly handle the nonprintable characters inside such files. I wrote the TYPEA .COM program, created by the TYPEA.ASM assembly language code in Figure 1 or the BASIC TYPEA.BAS program in Figure 2, to display just the ASCII characters in any file (including hidden files). All non-ASCII data are displayed as dots. To use it, just type

```
TYPEA filename
```

TYPEA works by reading the file into an internal buffer and examining each individual byte. It then replaces each non-ASCII code with a dot, and displays the entire file on-screen without any confusing control characters.

Tom Kihlken
St. Louis, Missouri

While programs we've published, such as Charles Petzold's BROWSE and Michael

```
; TYPEA.ASM  displays printable ascii characters in a file
; Programmed by Tom Kihlken
CSEG            SEGMENT
                ASSUME  CS:CSEG, DS:CSEG, ES:CSEG, SS:CSEG
                ORG     100H                    ;origin for .COM programs
;
START:          MOV     SI,80H                  ;point to parameters
                MOV     CL,[SI]                 ;get number of characters
                XOR     CH,CH                   ;make it a word
                MOV     BX,CX                   ;save number in BX also
                OR      CL,CL                   ;were any entered?
                MOV     DX,OFFSET NO_FILE_MESS
                JZ      ERR_EXIT        ;if no params, just exit
                INC     SI                      ;point to first character
                CLD
DEL_SPACES:     LODSB                           ;get character into AL
                CMP     AL,' '                  ;is it a space?
                JNE     FOUND_LETTER
                LOOP    DEL_SPACES
                JMP     SHORT ERR_EXIT          ;if no letters, just exit
;
FOUND_LETTER:   DEC     SI                      ;backup pointer to first letter
                MOV BYTE PTR $IN[BX],00         ;make it an ascii string
                MOV     DX,SI                   ;DS points to filename
                MOV     AX,3D00H        ;setup to open file handle
                INT     21H
                MOV     DX,OFFSET OPEN_ERR_MESS
                JC      ERR_EXIT        ;if unable to open, just exit
                MOV     BX,AX                   ;save the Handle
DUMP:           MOV     DX,OFFSET BUFFER    ;point to input buffer
                MOV     CX,65535        ;number of bytes to read
                MOV     AH,3FH                  ;setup to read from file
                INT     21H
                JC      ALL_DONE        ;quit on any error
                MOV     CX,AX                   ;number of bytes read into CX
                JCXZ    ALL_DONE        ;quit if nothing read
                MOV     SI,OFFSET BUFFER    ;point to buffer
NEXT_CHAR:      LODSB                           ;get a character into AL
                MOV     DL,'.'                  ;assume it's not printable
                CMP     AL,32                   ;is it less than 20
                JB      PRINT                   ;if yes, then print the dot
                CMP     AL,123                  ;is it greater than 123
                JA      PRINT                   ;if yes, then print the dot
                MOV     DL,AL                   ;put the letter in DL
PRINT:          MOV     AH,02                   ;function to display character
                INT     21H
                LOOP    NEXT_CHAR       ;do all the characters
                JMP     DUMP                    ;try to read some more
ALL_DONE:       MOV     AH,3EH                  ;setup to close the file
                INT     21H
                RET                             ;return to DOS
READ_ERROR:     MOV     DX,OFFSET READ_ERR_MESS
ERR_EXIT:       MOV     AH,09H                  ;DOS display string function
                INT     21H
                RET                             ;return to DOS
OPEN_ERR_MESS   DB      'File not found$'
READ_ERR_MESS   DB      'Error reading file$'
NO_FILE_MESS    DB      'Syntax: TYPEA filename$'
BUFFER          LABEL   BYTE
CSEG            ENDS
                END     START
```

Figure 1: *TYPEA.ASM, assembly language code to produce TYPEA.COM.*

```
100 ' Program to create TYPEA.COM -- by Tom Kihlken
110 CLS:PRINT "Checking DATA; please wait..."
120 FOR B=1 TO 10:FOR C=1 TO 16:READ A$:T=T+VAL("&H"+A$):NEXT
130 READ S:IF S<>T THEN PRINT "ERROR IN LINE";B*10+100:END
140 T=0:NEXT:RESTORE
150 OPEN "TYPEA.COM" AS #1 LEN=1:FIELD #1,1 AS D$
160 FOR B=1 TO 10:FOR C=1 TO 16:READ A$
170 LSET D$=CHR$(VAL("&H"+A$)):PUT #1:NEXT:READ DUMMY$:NEXT
180 CLOSE:PRINT "TYPEA.COM CREATED"
190 DATA BE,80,00,0A,0C,32,ED,8B,D9,0A,C9,BA,86,01,74,4F,1839
200 DATA 46,FC,AC,3C,20,75,04,E2,F9,EB,44,4E,C6,07,01,00,2025
210 DATA 00,8B,D6,B8,00,3D,CD,21,BA,64,01,72,32,8B,D8,BA,1020
220 DATA 9D,01,B9,00,40,B4,3F,CD,21,72,1C,8B,C8,E3,18,BE,1810
230 DATA 9D,01,AC,B2,2E,3C,20,72,06,3C,7B,77,02,8A,D0,B4,1596
240 DATA 02,CD,21,E2,ED,EB,D8,B4,3E,CD,21,C3,BA,73,01,B4,2311
250 DATA 09,CD,21,C3,46,69,6C,65,20,6E,6F,74,20,66,6F,75,1557
260 DATA 6E,64,24,45,72,72,6F,72,20,72,65,61,64,69,6E,67,1530
270 DATA 20,66,69,6C,65,24,53,79,6E,74,61,78,3A,20,54,59,1394
280 DATA 50,45,41,20,66,69,6C,65,6E,61,6D,65,24,00,00,00,1115
```

Figure 2: *BASIC TYPEA.BAS file to create TYPEA.COM.*

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■ TYPEA.COM is handy for looking at dangerous programs downloaded from bulletin boards.

Mefford's DR, also let you examine the contents of program files, this short program will also do the job. It's especially handy for looking at potentially dangerous "Trojan Horse" programs downloaded from bulletin boards. If you run a brand-new program through it and see something like "Gotcha!" you can erase it before it does any damage.

Executable files invariably contain CHR$(26) end-of-file markers that can stop the normal DOS TYPE command in its tracks. Try using the TYPE command to display COMMAND.COM, for instance, and the pr[illegible] two. TYPEA.[illegible]ill stop after a beep or through any fil[illegible]ill work all the way at the contents of [illegible]ll even let you look BIO.COM and IBI[illegible]es such as IBM-order nonprintable CM. you want it to simply dis[illegible]each lowters, create the file, get int[illegible]nds. If

```
DEBUG TYPEA.[illegible]rac-
E 148 A          e
E 14C 6
W
Q
```

EASY DOS MESSAGES

It's easy to have a batch file create another file interactively. The MSG.BAT batch file in Figure 3 illustrates this by asking the user to enter up to eight words at the DOS prompt and then creates a program that prints these on-screen. The syntax is

```
MSG PROGNAME WORD1 [WORD2]...[WORD8]
```

PROGNAME is the program name to be

```
ECHO OFF
IF %2!==! GOTO ERROR
CTTY NUL
ECHO E 100                                  > DBG.ZZZ
ECHO B4 09 BA 09 01 CD 21 CD 20            >> DBG.ZZZ
ECHO E 109 '%2 %3 %4 %5 %6 %7 %8 %9$'      >> DBG.ZZZ
ECHO N %1.COM                              >> DBG.ZZZ
ECHO RCX                                   >> DBG.ZZZ
ECHO 50                                    >> DBG.ZZZ
ECHO W                                     >> DBG.ZZZ
ECHO Q                                     >> DBG.ZZZ
DEBUG < DBG.ZZZ
DEL DBG.ZZZ
GOTO END
:ERROR
ECHO The correct syntax is
ECHO MESSAGE PROGRAM_NAME WORD1 [WORD2]...[WORD8]
ECHO Where: PROGRAM_NAME is the name of the .COM file
ECHO and WORD1 - WORD8 are words the program will print.
ECHO Note: DON'T use single quotes (') in any words.
ECHO And leave the .COM extension OFF your program name.
:END
CTTY CON
ECHO Now type %1
```

Figure 3: *MSG.BAT batch file that creates a .COM file interactively. Enter MSG PROGNAME WORD1 [WORD2]...[WORD8] where PROGNAME is the program name to be generated (don't add a .COM extension; the program will append one). Then enter up to eight words.*

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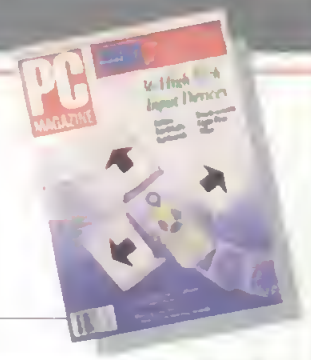

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■ USER-TO-USER

generated. The batch file will automatically give it a .COM extension, so don't add one yourself. You may enter up to eight words, so long as they don't wrap to the next line in DOS. If you entered MSG HELLO HI THERE it would create a file called HELLO.COM. If you then typed HELLO at the DOS prompt, it would print out HI THERE.

The batch file generates a DEBUG script file named DBG.ZZZ. It creates the file using a single > redirection operator, then appends the rest of the lines with a double >>. The actual assembler code is simple:

```
MOV AH,09  ; INT 21 print string
MOV DX,109 ; String address 109
INT 21     ; Call DOS INT 21
INT 20     ; Exit gracefully
```

This is followed by the string the user entered, and then a $ to tell INT 21 when to stop looking. I use a variation of this to insert individual serial numbers in copies of programs I sell.

Dave Bennett
Kansas City, Kansas

We added a CTTY NUL at the beginning and a CTTY CON at the end to clean up the display. The CTTY NUL will shut down your screen (until DOS sees the restorative CTTY CON command), so don't disturb the program or try to break out while it's running.

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I wrote the COPYEASY.BAT batch utility in Figure 4 to copy several groups of files from the current directory to another directory or disk. Everyone uses shorthand filespecs like *.BAT whenever possible, and COPYEASY makes it easy to use as many as eight shorthand filespecs on a single command line.

I share batch files with people who don't care to know the inner workings, so a friendly, helpful presentation on-screen is essential. This batch utility provides help if needed and specific feedback on what to type on the command line; it also requests confirmation before proceeding. This version uses only DOS commands, but more power to you if you incorporate ERRORLEVEL branching through a utility such as CHECK.COM (PC Lab Notes, Volume 6 Number 3).

David A. Coffin
Spring Valley, New York

This utility takes advantage of a slick DOS variable technique. Mr. Coffin uses replaceable parameters to read everything off the command line, and the DOS SHIFT command to process them one-by-one. Each time the SHIFT command executes, it moves all the replaceable parameters up a notch, so %3 becomes %2, %2 becomes %1, and the old value for %1 is discarded.

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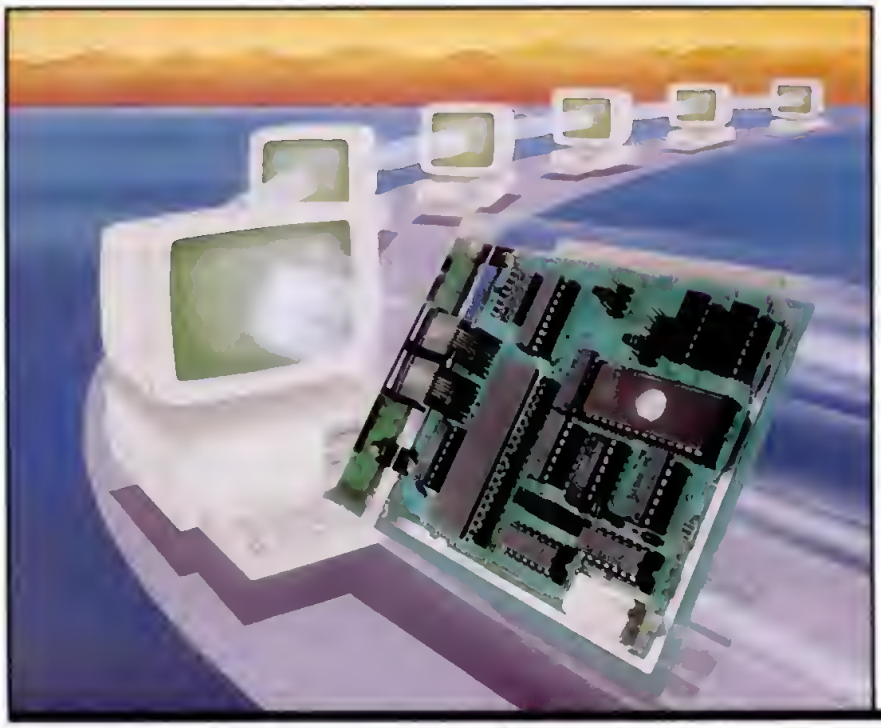

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So, if you entered the command

```
COPYEASY D: *.BAT C*.COM ??.EXE
```

then

```
%1 would = D:
%2 would = *.BAT
%3 would = C*.COM.
%4 would = ??.EXE
```

Execute SHIFT once and

```
%1 would = *.BAT
%2 would = C*.COM.
%3 would = ??.EXE
```

The old D: value of %1 would vanish, and %4 wouldn't have any value. (The %0 parameter is a special case—it represents the name of the batch file itself.)

The way the batch file works, %1 originally represents the destination for all the copies, and this is used the whole time the batch file runs. But the first time SHIFT executes, it wipes out the old value of %1 and replaces it with what used to be %2. Mr. Coffin gets around this by taking the origi-

```
ECHO OFF
IF "%2" == "" GOTO HELP
ECHO This will copy %2 %3 %4 %5 %6 %7 %8 %9
ECHO from
CD
ECHO to %1
ECHO Hit Ctrl-Break to abort, or
PAUSE
SET MYVAR=%1
SHIFT
:AGAIN
ECHO Copying %1 to %MYVAR%
FOR %%A IN (%1) DO COPY %%A %MYVAR% > NUL
SHIFT
IF NOT "%1" == "" GOTO AGAIN
SET MYVAR=
GOTO END
:HELP
ECHO To use this %0 utility, enter:
ECHO %0, DESTINATION, and up to 8 filespecs
ECHO in current directory.  For example:
ECHO ------------------------------------
ECHO %0 B: *.BAT *.D?? MYFILE.TXT TEST.*
ECHO ------------------------------------
:END
```

Figure 4: *COPYEASY.BAT utility that lets you copy up to eight filespecs on one command line.*

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■ USER-TO-USER

nal value of %1 and setting it to an environment variable, with the command

```
SET MYVAR=%1
```

He can then use this destination at any subsequent time in the batch file by referring to it as %MYVAR% rather than %1. And he cleans up after the batch file is done by removing the variable from the environment with the command

```
SET MYVAR=
```

If you do try this, make sure your environment is large enough to hold the extra variable. Under DOS 2.0 and 2.1, you can patch COMMAND.COM at address ECF to represent the number of 16-byte memory "paragraphs" that will make up your new environment. (For DOS 2.11, the address is DF3.) For DOS 3.0 and 3.1, use a SHELL [d:][path]COMMAND.COM /E:n /P command in your CONFIG.SYS file, where n represents the number of 16-byte paragraphs. For Versions 3.2 and later, use the same SHELL command but specify the actual number of bytes rather than paragraphs. The default in all cases is 160 bytes (10 paragraphs). You can jack it all the way up to 32K in DOS 3.2 and 3.3, but you are limited to 62 paragraphs in earlier versions.

■ The COPYEASY.BAT utility takes advantage of a slick DOS variable technique.

Paul Somerson is an executive editor on the staff of PC Magazine.

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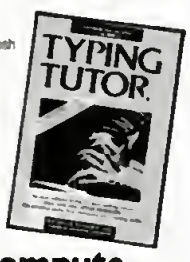

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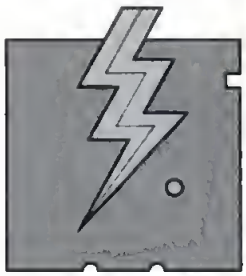
If you can't type, you can't compute

CIRCLE 170 ON READER SERVICE CARD

■ EDITED BY CRAIG L. STARK



POWER USER

Gaining full control of remote Crosstalk systems; converting WordPerfect files to Microsoft Word via WordStar; initializing dBASE memvars; quick XyWrite footnote editing.

REMOTELY INSECURE

While *Crosstalk*'s remote control features are theoretically limited, there is a way to gain almost full control of an answering *Crosstalk* system. Normally, even if the receiving *Crosstalk* is set up to ACcept Everything, the caller is prevented from using the ERASE command, for example. However, the receiving *Crosstalk* does give you access to the RUN command, and this lets you execute any DOS command on the receiving system. The catch is that you never get to see the results of the command you run, nor see or answer any prompts.

You can use the DOS CTTY command to overcome that limitation. To use it, you need two batch files on the answering system. The first file is OVERRIDE.BAT:

```
CD \
CTTY COM1
COMMAND
```

The second file is RESUME.BAT:

```
CTTY CON
EXIT
```

To use these files from the remote location, simply enter the command key (usually Ctrl-C), then enter the command RUN OVERRIDE.BAT.

The batch file's CD command gets you into the root directory of the answering system, where COMMAND.COM is located. The CTTY command redirects all DOS input and output to the COM1 serial port. (Change this line to COM2 if appropriate for your modem setup.) The third line loads a copy of COMMAND.COM and gives you the normal DOS prompt, sending it out the serial port to the remote system. At this point you can execute any DOS command and receive replies and prompts. There are limitations to this procedure, however, as a number of programs ignore the CTTY command and still run on the host monitor and keyboard.

When you are finished, run the RESUME batch file. The CTTY command returns control to the answering system's keyboard and monitor. EXIT terminates the extra copy of COMMAND.COM and returns the system to *Crosstalk*.

Crosstalk users, please note: your system isn't as secure as you may have thought. I strongly suggest using the *Crosstalk* password facility if you are going to have your system set up in answer mode with ACcept Everything in effect.

Scott Ward
Cincinnati, Ohio

■ *Crosstalk* users, please note: Anyone who sets up a system for unattended, remote operations without password protection is asking for trouble.

Ward's last point bears emphasis: Anyone who sets up a system for unattended, remote operations without password protection is asking for trouble. If someone gets on a Crosstalk *system and downloads the OVERRIDE.BAT file, he or she can not only look at everything on your system but can erase files, modify them, or otherwise destroy them. Moreover, if you want complete remote access to your system, the answer is to get* Carbon Copy, PC Anywhere, *or* Close-up. *Any of these programs will let you run virtually any program from a remote computer without worrying whether the program ignores the CTTY command.*—M. David Stone

CROSSTALK AND THE BUSY SIGNAL

Many modems now can detect and report busy signals, but this feature is of little use with *Crosstalk*'s redial command. The program has no way to take advantage of the BUSY response produced by my Hayes-compatible modem. This deficiency can be corrected though script files, however. The first script below, CALL.XTS, gets the number to dial. It first displays the file NUMBERS.OUT, which is a list of phone numbers. It then asks for the number to dial and places that number into function key F4. Finally, it calls up the script DIAL.XTS.

```
TYPE A:NUMBERS.OUT
ASK @F4 ENTER NUMBER TO DIAL..
DO DIAL
```

DIAL.XTS dials the number and will immediately hang up and redial if the modem reports a busy signal. The first line

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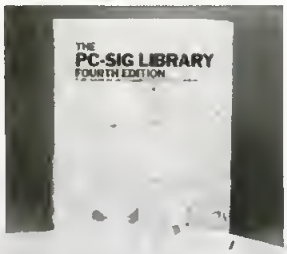

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■ POWER USER

tells the script to restart if the modem reports BUSY. The second and third lines ensure that the command line is empty. The fourth and fifth lines ensure that the modem is at its wake-up state (which should be set to use English responses rather than the short, numerical responses that *Crosstalk* usually wants to see). Lines 6 through 9 send the dialing command to a Hayes-compatible modem. The last lines wait for the connect message, then sound the alarm, and clear the when statement.

```
WHEN "BUSY" RWIND
GO LOCAL
REPLY "|"
WAIT DELAY 5
REPLY "ATZ|"
WAIT DELAY 5
REPLY "ATDT"
REPLY @F4
REPLY "|"
WAIT STRING "CONNECT 1200"
ALARM 3 NOW ; AL ; AL ; AL ; AL ; AL
WHEN -
```

Jeffrey S. Harrington
Moreno Valley, California

Readers may want to make a few adjustments to these scripts. First, depending on your computer's clock speed, the DELAY 5 in the wait statements might not be long enough. On an AT, for example, I had to increase the wait to DELAY 15. Second, the file NUMBERS.OUT must be short enough to fit on one screen, or else the top of the file will scroll off the screen before you can read it. If you have SideKick, *you may prefer to use the* SideKick *notepad to read your phone directory.*

Also, you shouldn't have to clear the command line with each redial. You can speed up the redialing by putting the following lines in CALL.XTS instead of DIAL.XTS:

```
GO LOCAL
REPLY "|"
WAIT DELAY 15
REPLY "ATZ|"
```

These clear the command line and reset the modem to its wake-up state before you start dialing, without adding the extra wait for each redial. Less important, you might prefer Alarm 0 over Alarm 3. Alarm 0 plays a little tune that is less jarring than Alarm 3 and lasts longer, making it harder to miss. Finally, be aware that, beginning with Version 3.61, Crosstalk *can take advantage of both the BUSY detection and NO DIALTONE detection of the new Hayes modems. To take advantage of this feature, the DPrefix must be set to*

```
ATV0X4~|ATDT
```

It's the X4 setting that lets the modem react to busy signals and dial tones. The V0 sets the modem to use the short, numeric responses that Crosstalk *needs to see. According to a* Crosstalk *representative, registered users of* Crosstalk, *Version 3.4 or later, can get free upgrades to Version 3.61.*

Unfortunately, many "Hayes-compatible" modems use different numeric result codes than Hayes uses, so the new Crosstalk *will not add the busy signal detection for them. For these modems Mr. Harrington's script will still work as advertised.*
—M. David Stone

IMPROVING WORD MAIL-MERGE

One failing in *Microsoft Word*'s merge facility is its inability to begin at an arbitrary "page" in a long data file being merged. If you've had a paper jam, for example, and you have to pick up printing at letter 26, you can't simply tell *Word* to start printing at letter 26.

The IF statement offers a way around this shortcoming. First, always create your data files with each record numbered with a NUMBER field. Then, if you want to print from the middle of the data file, you only have to add two statements to your merge document. The first goes immediately after the DATA statement:

```
«IF NUMBER > x»
```

where $x + 1$ is the first record you want to print. (In *MS Word* you can enter the double angle-brackets (guillemets), ASCII 174 (<<) and 175 (>>), as Ctrl-[and Ctrl-].) The second is the <<ENDIF>> statement, which should be the last line in your merge document. Now you can merge the file starting with any arbitrary record. You can also print subsets of your data using essentially the same trick (e.g., IF STATE = CA). The only problem is that *Word* insists on ejecting a blank page for each record skipped in the data file. This is not an issue if you're using single sheets but can waste a lot of paper if you

are using form-feed paper.

To avoid wasting paper, or if you don't want to add a NUMBER field to your data files, another solution is to load your merge file in one window and your data file in a second. Delete those records already printed, and then merge-print. When finished, simply clear the window and reply "N" when asked if you want to save the edits. This allows you to print just the records you need without producing pages of blank forms or labels.

Don W. Stacks
Tuscaloosa, Alabama

Even easier than using a NUMBER field, get in the habit of sorting your data files before merging. You can use any field to sort on, and it will automatically give you a way to take advantage of the IF statement. Further, Word *does not have to eject a blank page for skipped records. Simply put the IF statement immediately after the data statement, on the same line, and put the ENDIF statement as the last entry in the merge document, but as the first line of a new page.*—M. David Stone

INITIALIZING dBASE VARIABLES

To automate writing the code needed to initialize memory variables when appending new records, I've written the *dBASE III Plus* programming utility shown in Figure 1. The program produces a text file, MEMINIT.TXT, that contains the STORE statements to initialize a new memory variable for each field in the database (memo fields excepted, of course). When the resulting code is run inside a program, each new memvar will have the correct field type and field length, and its name will be identical to the database field except for the prefixed "m". If the database field name is already at *dBASE*'s ten-character limit, the resulting memvar name is truncated to ten characters.

For example, if you use a database file with the following structure:

Name	Type	Len	Dec
SDATE	D	8	0
EDATE	D	8	0
CO	C	25	0
STR	C	25	0
CITY	C	14	0

MEMINIT.PRG will produce a text file with the following code lines:

```
STOR SPAC(14) TO mcity
STOR SPAC(25) TO mco
STOR SPAC(25) TO mstr
STOR DATE() TO msdate
STOR DATE() TO medate
```

Because the temporary file that holds the field names is indexed on field type and field length, like data types are grouped and arranged from shortest to longest. This makes it easy to combine identical items into more-efficient statements, e.g., STOR SPAC(25) TO mco,mstr.

Fred Wampler
Church Hill, Tennessee

Of the many ways dBASE *provides for appending new records, the most efficient method is usually to initialize matching memory variables (as Mr. Wampler's program does), GET the memvars from the user, run any error checking, then APPEND BLANK and REPLACE the fields with the matching memvars.*

Mr. Wampler's routine combines several powerful but underused techniques. COPY STRUCTURE EXTENDED creates a new database with one record describing

```
*** MEMINIT.PRG   (file must be in use)
SET TALK OFF
PRIV c,n,l,d,x
COPY STRU EXTE TO temp
SELE 9
USE temp
INDE ON field_type;
  +STR(field_len,3) TO temp
SET FILT TO field_type$"MN"
GO TOP
n="0"
l=".F."
d="DATE()"
SET ALTE TO meminit.txt
SET ALTE ON
DO WHIL .NOT. EOF()
  c="SPAC("+LTRIM(STR(field_len,3))+")"
  x=field_type
  ? "STOR",&x,"TO ";
   +TRIM(LOWER(LEFT("m"+field_name,10)))
  SKIP
ENDD
SET ALTE TO
USE
ERAS temp.dbf
ERAS temp.ndx
SELE A
RETURN
```

Figure 1: *A* dBASE III Plus *code generator that produces a text file with the STORE statements needed to initialize memory variables before appending new records.*

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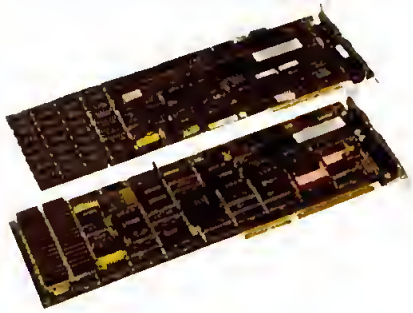

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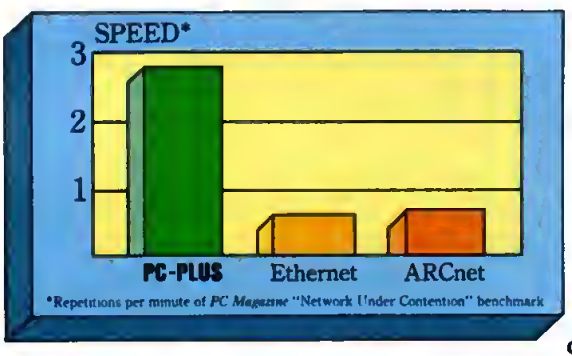

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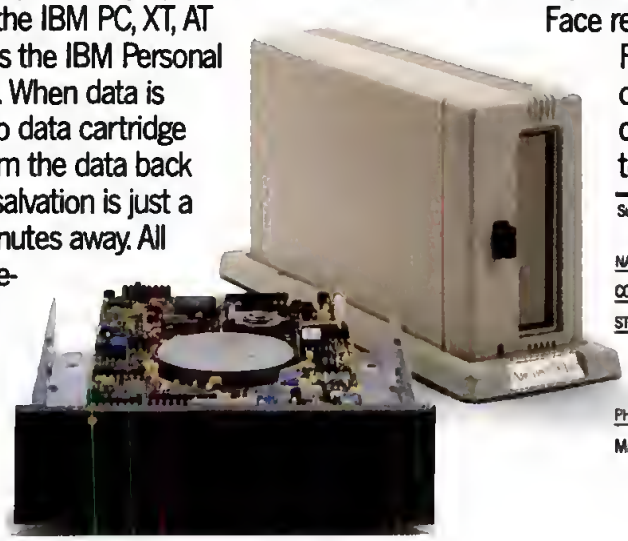

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■ POWER USER

each field of the main .DBF. The variables c, d, l, *and* n *hold the default initializations for each field_type. Note that* c *must be initialized inside the loop in order to hold the correct field_len. Once the ALTERNATE is turned on, each "?" statement will be saved in a text file, ready for incorporation into your program. As the loop progresses, the variable* x *does double-duty. First it picks up the current field_type from the database. Then the &x macro converts the field_type into the value of its corresponding memvar, producing the proper default.*

If you will be using these m-variables as macros, you must truncate their length at 9 instead of 10. Also, remember that the m-variables are not PUBLIC, so dBASE *will discard them when your appending routine RETURNs to the program that originally called it.*

Note that this routine has two lines specific to dBASE III Plus, *both inside the DO WHILE loop. If you are using* dBASE III, *which lacks the LTRIM function, substitute the following for the line where* c *is stored:*

```
DO CASE
CASE field_len<10
  c="SPAC("+STR(field_len,1)+")"
CASE field_len<100
  c="SPAC("+STR(field_len,2)+")"
OTHER
  c="SPAC("+STR(field_len,3)+")"
ENDCASE
```

Again with dBASE III, *substitute*

```
+TRIM(SUBS("m"+field_name+SPAC(8),1,10))
```

for

```
+TRIM(LOWER(LEFT("m"+field_name,10)))
```

—Brad Stark

EDITING XYWRITE III FOOTNOTES

To edit footnotes you've already written, the *XyWrite Applications Tutorial* suggests positioning the cursor near the note and switching to expanded display. But it's less cumbersome to use the EF (Edit footnote) function call directly. By locating the cursor on the footnote number and pressing a key that invokes EF, I open the footnote window for editing without having to leave the normal display.

Because the EF function is not assigned to a key in the standard *XyWrite* keyboard, I decided to assign it to Ctrl-E. You do this by finding the TABLE=CTRL sequence in the IBM.KBD file and adding the line

```
18=EF
```

Not only does this provide a fast and easy method for editing footnotes, but it also works for editing headers and footers.

Kent N. Schneider
Johnson City, Tennessee

This tip only works in XyWrite III *or* III Plus. *You can improve on it by using a single keystroke to search for the next footnote and open it automatically.* XyWrite III *won't let you search for a note while you're in normal display mode, so you have to go briefly into expanded mode to search for the footnote command, then return to normal mode and use function EF to open the note. If you want to use Ctrl-E for all this, put the following line in IBM.KBD under TABLE=CTRL:*

```
18=XP,BC,e,e, ,\,e,f,n,\,XC,WG,EF
```

The XP function call switches the display to expanded mode (this is what happens when you hit Ctrl-F9). The BC pops the cursor up to a blank command line, and the following characters search for the embedded footnote command. Don't forget the space between the commas after the "e". (To key in the left European angle bracket, hold down Shift and Alt, and type 174 on the numeric keypad. Then release the Shift-Alt combination.) The function call XC executes the search, WG returns to normal display mode, and EF opens the window for editing the note. If there are no more notes left in your file, XyWrite *beeps at you.*

If you don't like the minor distraction of seeing the display switch briefly into expanded mode while searching, just insert the function call DX (Display Off) before XP and put DO (Display On) after WG. (Separate all these calls with commas.) This change will turn off the display during the search and turn it on again when the search is complete.

When you've modified the keyboard file, store it and load it into memory with the command LDKBD IBM.KBD. Now you can edit footnotes without taking the trouble to look for them. [If your need for footnote editing is less extensive than that of Prof. Mendelson, you may find it easier just to put the cursor on the footnote number, pop up to the command line by hitting F5, and type FUNC EF, followed by Enter or F9. This technique is good only for one shot at a time but doesn't require keyboard reassignments.—Ed.]
—Edward Mendelson

DOUBLE CONVERSION

Neither *WordPerfect* nor *Microsoft Word* comes equipped with a conversion routine for the other, and printing to disk in *WP* produces files with a carriage return character at the end of every line and many extraneous spaces when loaded into *Word*. A friend and I discovered a neat solution: a common intermediate file type. Both *WP* and *Word* have routines to convert to and from *WordStar* (*WS*) files. Converting a fully formatted *WP* file into *WS* format, and then converting from *WS* to *Word* format results in a fully formatted *Word* file with underscoring, boldface, and other attributes. The only small glitch is an easily deleted *WS* header in the *Word* file.

Paul Sommers
Seattle, Washington

What a relief to be able to convert documents from WP *to* Word *or vice versa without having to make them into ASCII text! This is a simple tip, but without it you're in for a lot of unnecessary work.*
—Neil J. Rubenking

Craig L. Stark is senior editor for technical columns of PC Magazine. *Edward Mendelson is a frequent contributor to* PC Magazine. *Brad Stark is a* dBASE *programmer and consultant based in North Scituate, Massachusetts. M. David Stone is a contributing editor of* PC Magazine.

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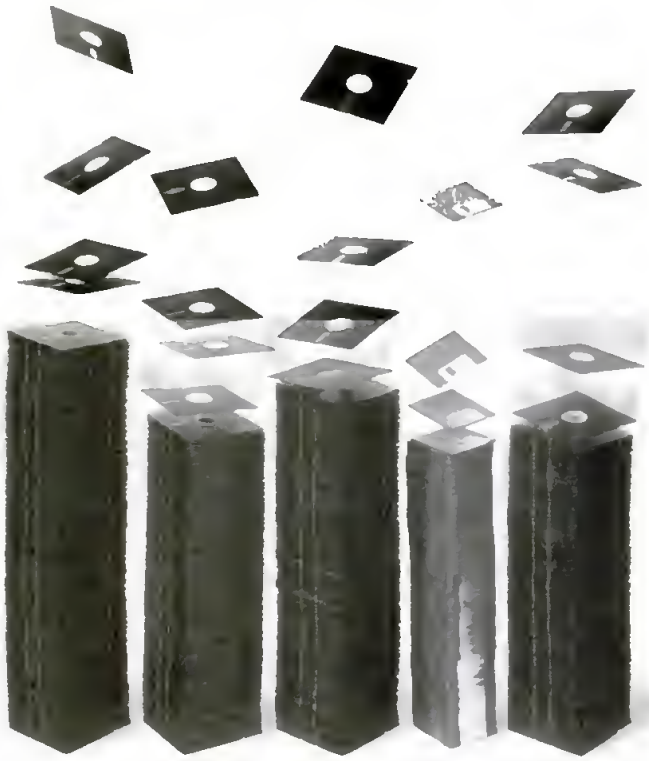

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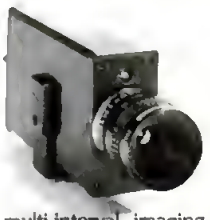

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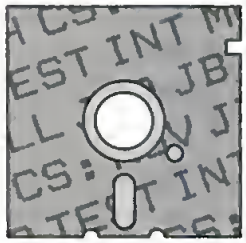
CIRCLE 728 ON READER SERVICE CARD

■ EDITED BY ROBERT L. HUMMEL



LANGUAGES

Word wrap for BASIC; using BASIC's hidden CEIL function; tricking QuickBASIC into loading graphics characters; taming the stack in QuickBASIC; LPT2 support in Turbo Pascal.

BASIC

SMART WORD WRAP

We use a number of BASIC programs to generate the various reports needed by our hospital cardiology lab. Since BASIC displays long strings that are output to the screen or to a printer by dividing the lines at the edge of the screen—regardless of whether this occurs between a word or not—I have developed the enclosed program (see Figure 1) to improve the appearance of these reports. By forcing divisions to occur between complete words, rather than in the middle of a word, we can implement a word-wrap function.

Diane Kaluza
St. Clair Shores, Michigan

Ms. Kaluza submitted a BASICA program that processed strings up to 240 characters long. It consisted of three separate blocks of code, each handling a different portion of the string. Since most serious BASIC programmers are now using QuickBASIC or Turbo Basic, I rewrote her routine as a callable subprogram. Besides being substantially smaller than the original, this version also accommodates strings of any length.—Ethan Winer

NUMERICAL LIMITS

In "Turbocharging BASIC" (PC Lab Notes, Volume 6 Number 11), Ethan Winer stated that Turbo Basic has an advantage over QuickBASIC because it offers a CEIL function, which finds the next higher amount, as opposed to INT, which truncates a value downward. BASIC actually has a "hidden" Ceiling capability: the user-defined function

```
DEF FNCeil(X) = -INT(-X)
```

will produce the desired result.

William Mooney
Old Bridge, New Jersey

This once again proves that the simplest approach that still gets the job done is always the best. Since INT returns the largest integer that is not greater than the argument, INT(−7.8) will equal −8, and −INT(−7.8) comes out as the desired 8.—Ethan Winer

QUICKBASIC

HANDLING SPECIAL CHARACTERS

I use ANSI graphics for designing screens with Microsoft's QuickBASIC, but I've found that once you save a file that contains ANSI graphics codes, you can't reload it. If you try, QuickBASIC will give you an annoying "Cannot edit binary files" message.

After much experimentation, I discovered that there is a way to trick QuickBASIC into loading the file for editing. Simply invoke the Run menu and enter the program name there. In order to compile the program, QuickBASIC will load it into the editor, apparently skipping any tests it performs when loading from the File menu.

Julio Gonzalez
Miami, Florida

I've recently converted from BASICA to Microsoft's QuickBASIC but have been disturbed to discover that the QuickBASIC editor supports the extended ASCII characters only partially. I often like to use graphic boxes in my programs, but when I

```
Line Input "Type any string: ", ST$
Call PrintWrap(ST$)

Sub PrintWrap(X$) Static
    Pointer = 1                          'tracks start of each group of 80 chars
More:
    For X = Pointer + 80 To Pointer Step -1          'examine a block
        If Mid$(X$, X, 1) = " " Or X = Len(X$) + 1 Then 'found space or at end
           Print Mid$(X$, Pointer, X - Pointer);     'print this block
           Pointer = X + 1                           'consider next block
           While Mid$(X$, Pointer, 1) = " "          'swallow extra blanks
               Pointer = Pointer + 1                 '  between words
           Wend
           X = 0                                     'exit For/Next loop
           If Pos(0) > 1 Then Print                  'didn't fill the line
        End If
    Next
    If Pointer < Len(X$) Goto More                   'still more to do
End Sub
```

Figure 1: *A program that prints long strings with word wrap.*

tried to load a program with these characters into the editor, I got the "Cannot edit binary files" error message.

The solution is to add a comment with only normal characters as the first line in the program, like this:

```
5 'Comments  ************
```

Wie Liem
Lakeland, Florida

As of Version 3.0, Microsoft has cleuned up the way QuickBASIC determines whether a source file is in BASICA's binary format. It is still possible to create a legitimate file that QB3 thinks is binary, but you'll have more trouble doing so thun previously. Nonetheless, if you need them, both of these techniques work us advertised.—Ethan Winer

MONITORING STACK USE

As a software developer who uses BASIC, I have been very excited by the new debugging features contained in Microsoft's QuickBASIC 3.0. Still missing, however, is the ability to monitor the current stack pointer register setting. This is important because some BASIC commands use up stack space, and there's only so much available. Therefore, I wrote a very short but useful assembly language subroutine, shown in Figure 2, that will report the stack register setting.

The easiest way to incorporate StakInfo into your programs is to assemble the listing with the Microsoft or IBM assembler (Version 2 or later) and then use the BuildLib utility included with QuickBASIC, thus:

```
MASM StakInfo;
BUILDLIB StakInfo;
```

This creates a file named USERLIB.EXE that can be loaded into the QuickBASIC editing environment with the /L command. Thereafter, whenever you want to know the current stack pointer register setting, simply add these instructions to your program:

```
Call StakInfo(SP%) : Print SP%
```

Be sure that the variable being passed to StakInfo is an integer, since single- or double-precision values will not be handled correctly.

Scott Dempsey
Florence, South Carolina

```
;StakInfo.Asm

Code      Segment Byte Public 'Code'
          Assume  CS:Code
          Public  StakInfo

StakInfo  Proc    Far

Begin:    Push BP              ;save BP for BASIC
          Mov  BP,SP           ;locate address for SP%
          Mov  SI,[BP+06]      ;put address into SI
          Mov  [SI],SP         ;put stack pointer into SP%
          Pop  BP              ;restore BP
          Ret  2               ;return to BASIC

StakInfo  Endp
Code      Ends
          End  Begin
```

Figure 2: *An assembler routine that returns the stack register setting.*

For many BASIC programmers the stuck remains one of the least-understood topics of their cruft. Even though u program is uble to control how much memory is reserved for the stack (using the Clear command), the QuickBASIC documentation offers little guidance for determining what that value should be. With Mr. Dempsey's routine, I wus able to determine the umount of stack space needed for a variety of programming situations.

In a BASIC program, the stuck hus two primary uses: it retains the address to which to return after a Gosub or Call, and it stores the addresses of variables being passed to a subprogram. For example, every time a Gosub is performed, 2 bytes are used, while a Call to a BASIC subprogram with no parameters requires 10 bytes. Each simple vuriable passed in a parameter list uses an additional 2 bytes, and each one-dimensional array adds 10 more. On top of that, plun on another 2 bytes per dimension when using multidimensioned arrays.

Using this as a guideline, you can easily determine the amount of stack memory required by your programs, based on the number of parameters being passed and the depth of subprogram nesting. There are, however, a few udditional things to take into account.

When u QuickBASIC program is running, the stuck is kept within the normal data area that is used for storing strings, simple vuriables, and stutic arrays. This means that you can't arbitrarily set aside some huge vulue and still expect to have much memory left. Many explanations of the stack compare it to a stack of dishes in a diner, where new values are placed higher and higher on the pile. In a PC, though, the stack actually grows downward, *towards lower-numbered addresses. Thus, StakInfo will report ever-lower numbers when it is called from within nested subprograms.*

■ For many BASIC programmers the stack remains one of the least-understood topics.

Again, when calculating the amount of stuck space required for a given progrum, be uware that the stack is also used by DOS und the BIOS for their own internal

■ LANGUAGES

■ The vast majority of BASIC programs will run just fine without *any* fussing over the stack.

purposes. Since the 8088 is capable of maintaining only one stack, all of the operating system services will use BASIC's stack when a BASIC program is running. A safe margin would probably be to leave an extra 512 bytes beyond what you determine the program needs.

As a final note, the vast majority of BASIC programs will run just fine without any *fussing over the stack, since a fairly hefty 768 bytes are set aside as a default.* —Ethan Winer

TURBO PASCAL

LPT2 SUPPORT

Many Turbo users have asked how they can write to printer ports other than the default LPT1. The technique is not difficult, but neither is it obvious. You must declare the printer as a text file, assign it the appropriate logical device name, and Rewrite it before you can use it. The short program shown in Figure 3 demonstrates writing both to LPT1 and LPT2 using this technique.—Neil J. Rubenking

```
PROGRAM Printer_2;
VAR
  lpt1, lpt2 : text;
BEGIN
  Assign(lpt1,'LPT1');
  Assign(lpt2,'LPT2');
  Rewrite(lpt1);
  Rewrite(lpt2);
  WriteLn(LPT1,' THIS is printer one');
  WriteLn(LPT2,' THIS is printer two');
END.
```

Figure 3: *A Turbo Pascal program that writes to the default and a nondefault printer port.*

Robert L. Hummel is senior technical editor on the staff of PC Magazine. *Ethan Winer is the head of Crescent Software in East Norwalk, Connecticut, and is a contributing editor of* PC Magazine. *Neil J. Rubenking is a contributing editor of* PC Magazine.

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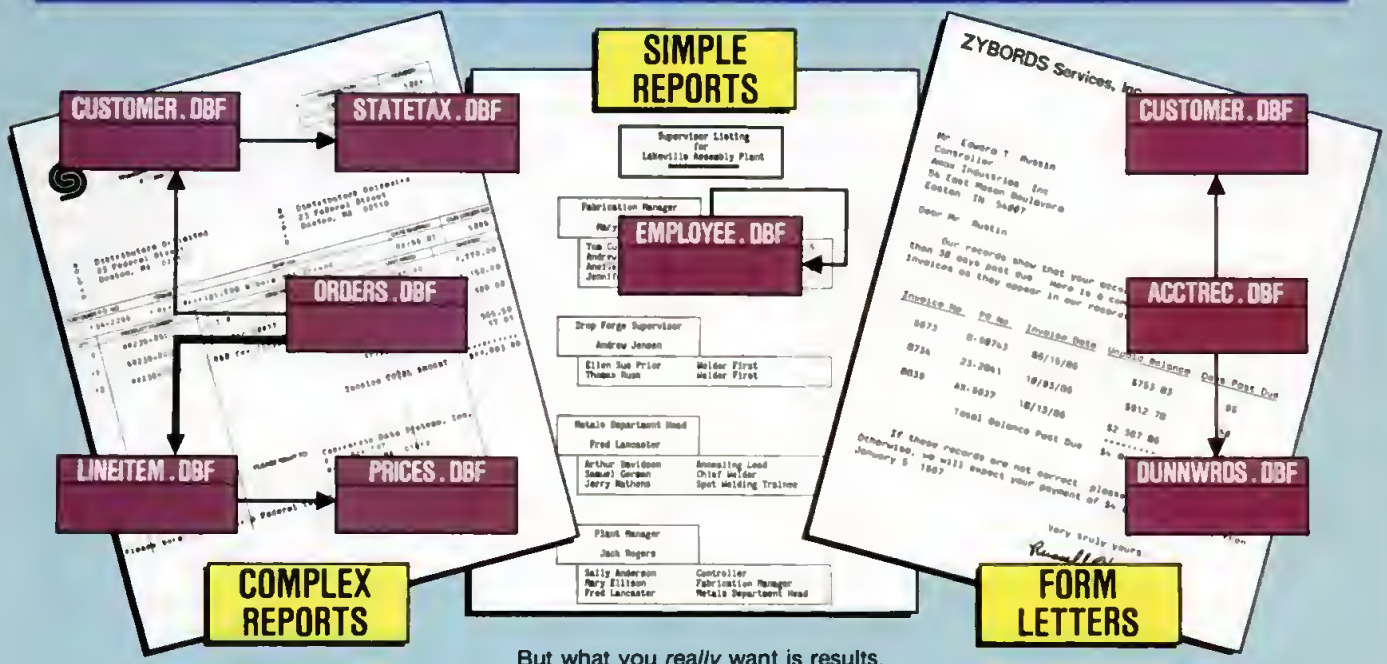

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PC TUTOR

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KEYBOARD CONFUSION

Some BASIC programs I'm writing need to access the keyboard. Where can I get information on the scan codes for the new keys on the IBM Enhanced Keyboard so I can redefine them, as well as Ctrl-C, Ctrl-Break, and PAUSE?

Michael Johnston
Charlotte, North Carolina

Since there's a lot of confusion about keyboard terminology, let me clarify some terms before answering your question. IBM has assigned each key on the keyboard a "key number" that simply identifies the physical location of the key. Programmers should ignore these key numbers.

When you press a key, the keyboard controller generates a "make" code. Similarly, a "break" code (whose value is the make-code + 80h) is generated when you release the key. These unique, 8-bit values are called "scan codes." Most TSR programs work with these codes to watch for their "hot keys." Since looking up these scan codes in the technical manuals is confusing and time-consuming, I've written

```
;  SCAN.COM - Display the scan code for any key hit.
;  By Robert L. Hummel for PC Magazine  (c)1987 Ziff Communications Co.
CSEG    SEGMENT PARA    PUBLIC  CODE'

        ASSUME  CS:CSEG,DS:CSEG,ES:CSEG,SS:CSEG

                ORG     100H                    ;.COM file entry at 100H

ENTPT:          JMP     SHORT MAIN

OLD_INT_9       DD      ?                       ;Store old interrupt vector
QUIT            DB      ?                       ;0 to stay in loop

MAIN            PROC    NEAR

                MOV     AH,3509H                ;Get interrupt 9
                INT     21H                     ;Result in ES:BX

                MOV     WORD PTR OLD_INT_9[0],BX ;store in memory OFFSET:SEG
                MOV     WORD PTR OLD_INT_9[2],ES ;in form for jump

                MOV     DX,OFFSET INT_9         ;Offset of our progrma
                                                ;DS:BX points to our entry
                MOV     AH,2509H                ;Set interrupt 9
                INT     21H                     ;Thru DOS

GET:            CMP     QUIT,0
                JE      GET

                LDS     DX,OLD_INT_9            ;Int address in DS:DX
                MOV     AH,2509H                ;Restore old vector
                INT     21H

                MOV     AX,4C00H                ;Terminate progrma
                INT     21H

MAIN            ENDP

;       New Interrupt 9 routine. Invoked each key-press.
;       Test to see if our key combination has been typed.
INT_9   PROC    NEAR
        ASSUME  CS:CSEG,DS:NOTHING,ES:NOTHING,SS:NOTHING

                STI                             ;Allow interrupts
                PUSH    AX

                IN      AL,60H                  ;Get key scan code
                CMP     AL,39H                  ;Is it space bar
                JNE     CONTINUE

                INC     CS:QUIT                 ;Say to Quit
                JMP     EXIT
CONTINUE:
                XOR     AH,AH

                CALL    HEX2COM
EXIT:
;       Reset   the keyboard (forget the key stroke)
                IN      AL,61H                  ;These instructions reset The
                MOV     AH,AL                   ;keyboard.
                OR      AL,80H
                OUT     61H,AL
                MOV     AL,AH
                OUT     61H,AL
                CLI                             ;Disable interrupts and
                MOV     AL,20H                  ;reset the int cnotroller
                JMP     $+2                     ;I/O delay
                OUT     20H,AL

                POP     AX
                IRET

INT_9           ENDP

;  HEX2CDS - print AL to CON as 2 hex digits.
HEX2CDS         PROC    NEAR

                PUSH    AX                      ;Save register

                PUSH    CX
                MOV     CL,4
                SHR     AL,CL                   ;Get high 4 bits
                POP     CX

                CALL    H2C
                POP     AH
                AND     AL,0FH
H2C:
                ADD     AL,90H                  ;Convert AL to ASCII
                DAA
                ADC     AL,40H
                DAA
                MOV     AH,0EH                  ;Write TTY
                INT     10H
                RET

HEX2COM         ENDP

CSEG    ENDS
        END     ENTPT
```

Figure 1: *Assembly language program for SCAN.COM.*

■ PC TUTOR

```
100 REM -- BASIC PROGRAM TO CREATE SCAN.COM
110 OPEN "SCAN.COM" AS #1 LEN = 1
120 FIELD #1,1 AS A$
130 CHECKSUM = 0
140 FOR I = 1 TO  15
150    LINESUM = 0
155    PRINT ".";
160    FOR J = 1 TO 8
170       READ BYTE
180       CHECKSUS = CHECKSUM + BYTE
190       LINESUM = LINESUS + BYTE
200       IF (BYTE < 256) THEN LSET A$ = CHR$(BYTE)
210       PUT #1
220    NEXT J
230    READ LINECHECK
240    IF LINECHECK <> LINESUS THEN PRINT "Error in Line";200 + 10 * I
250 NEXT I
260 CLOSE
270 IF CHECKSUM = 10857 THEN PRINT "Complete" : END
280 PRINT "COM file is not valid" : END
290 DATA    235,     5,     0,     0,     0,     0,     0,   104,   424
300 DATA      9,    53,   205,    33,   137,    30,     2,     1,   470
310 DATA    140,     4,     4,     1,   104,    40,     1,   104,   571
320 DATA      9,    37,   205,    33,   128,    62,     6,     1,   481
330 DATA      0,   114,   249,   107,    22,     2,     1,   104,   771
340 DATA      9,    37,   205,    33,   104,     0,    74,   205,   740
350 DATA     33,   251,    80,   220,    96,    60,    57,   117,   822
360 DATA      0,    44,   254,     4,     4,     1,   235,     8,   582
370 DATA    144,    50,   220,   232,    21,     0,   220,    87,  1000
380 DATA    130,   224,    12,   128,   230,    87,   130,   104,  1143
390 DATA    230,    87,   250,   176,    32,   235,     0,   230,  1250
400 DATA     32,    80,   207,    80,    81,   177,     4,   210,   879
410 DATA    232,    89,   232,     3,     8,    80,    36,    15,   405
420 DATA      4,   144,    39,    20,    44,    30,   100,    14,   584
430 DATA    205,    16,   105,     0,     0,     0,     0,     0,   414
```

Figure 2: *BASIC program to create SCAN.COM.*

```
;=============================================================================
;  BIOS.ASM  - For ASCII chars, show the scancode/ASCII code
;              For Non-ASCII, show extended code/extra byte
;  By Robert L. Hummel for PC Magazine. (c)1987 Ziff Communications Co.
;-----------------------------------------------------------------------------
CSEG      SEGMENT   PARA      PUBLIC    'CODE'

          ASSUME    CS:CSEG,DS:CSEG,ES:CSEG,SS:CSEG

                    ORG       100H                ;.COM file entry at 100H

MAIN                PROC      NEAR

                    PUSH      ES                  ;Save segment
                    XOR       AX,AX               ; and set to
                    MOV       ES,AX               ; BIOS data area
          ASSUME    SS:BOTBIOS

                    MOV       AH,12               ;Test to see if extended
                    INT       16                  ;functions are supported
                    MOV       AX,0                ;by setting shift flags.
                    CMP       AL,BYTE PTR ES:[417H]
                    JNE       NO_SUPPORT

                    XOR       BYTE PTR ES:[4176],80H
                    MOV       AH,12H
                    INT       16H
                    MOV       AH,0
                    CMP       AL,BYTE PTR ES:[417H]
                    JNE       NO_SUPPORT
                    MOV       AH,10H
SD_SUPPORT:
                    POP       ES                  ;Restore segment
                    PUSH      AX                  ;Save function in AH
KEY_LOOP:
                    POP       AX                  ;Get function
                    PUSH      AX                  ; and save for next time
                    INT       16H

                    CMP       AL,32               ;If spacebar, stop
                    JE        EXIT

                    XCHG      AH,AL               ;Print AX to the screen
                    CALL      HEX4CON
                    JMP       KEY_LOOP            ;Get another key
EXIT:
                    MOV       AX,4C00H            ;Terminate program
                    INT       21H

MAIN                ENDP

;=============================================================================
;  HEX4CON - print AX to CON as 4 hex digits.
;-----------------------------------------------------------------------------
HEX4CON             PROC      NEAR

                    PUSH      AX                  ;Save value
                    CALL      HEX2CON             ;Print AL
                    POP       AX                  ;Get back value
                    XCHG      AH,AL               ;Swap
                                                  ;Drop through
HEX2CON             PROC      NEAR

                    PUSH      AX                  ;Save register

                    PUSH      CX                  ;Isolate high 4 bits
                    MOV       CL,4
                    SHR       AL,CL
                    POP       CX

                    CALL      H2C
                    POP       AX                  ;Restore old value
                    AND       AL,0FH
H2C:                                              ;Drop through
                    ADD       AL,90H              ;Convert AL to ASCII
                    DAA
                    ADC       AL,40H
                    DAA
                    MOV       AH,0E               ;Write TTY
                    INT       10

                    RET

HEX2CON             ENDP
HEX4CON             ENDP

CSEG      ENDS
          END       MAIN
```

Figure 3: *Assembly language program for BIOS.COM.*

```
100 REM -- BASIC PROGRAM TO CREATE BIOS.COM
110 OPEN "BIOS.COM" AS #1 LEN = 1
120 FIELD #1,1 AS A$
130 CHECKSUM = 0
140 FOR I = 1 TO  12
150    LINESUM = 0
155    PRINT ".";
160    FOR J = 1 TO 8
170       READ BYTE
180       CHECKSUS = CHECKSUM + BYTE
190       LINESUS = LINESUS + BYTE
200       IF (BYTE < 256) THEN LSET A$ = CHR$(BYTE)
210       PUT #1
220    NEXT J
230    READ LINECHECK
240    IF LINECHECK <> LINESUS THEN PRINT "Error in Line";200 + 10 * I
250 NEXT I
260 CLOSE
270 IF CHECKSUS = 8675 THEN PRINT "Complete" : END
280 PRINT "COM file is not valid" : END
290 DATA      6,    51,   102,   142,   102,   100,    10,   205,   884
300 DATA     22,   100,     8,    30,    50,     4,    23,     4,   331
310 DATA    117,    21,    30,   120,    54,    23,     4,   120,   513
320 DATA    100,    10,   205,    22,   100,     8,    30,    50,   701
330 DATA      6,    23,     4,   117,     2,   100,    16,     7,   355
340 DATA     80,    80,    80,   205,    22,    40,    32,   114,   683
350 DATA      7,   134,   224,   232,     7,     8,   235,   241,  1000
360 DATA    104,     8,    76,   205,    33,    80,   232,     3,   813
370 DATA      8,    80,   134,   224,    80,    81,   177,     4,   760
380 DATA    210,   232,    80,   232,     3,     8,    80,    36,   890
390 DATA     15,     4,   144,    30,    20,    44,    39,   100,   585
400 DATA     14,   205,    16,   105,     0,     0,     0,     0,   430
```

Figure 4: *BASIC program to create BIOS.COM.*

■ SCAN.COM shows the scan code for any key on the keyboard. The make/break codes will be displayed on the screen.

SCAN.COM, which shows the scan code for any key on the keyboard. Run the program and press any key. The make/break code (in hex) for the key will be displayed on the screen. Note that holding a key down will cause the make code to auto-repeat. Figure 1 gives the source code for SCAN.ASM, while Figure 2 gives a BASIC program that will create SCAN.COM directly. Pressing the Spacebar will exit the program and return to DOS. Because of this, the program cannot be used to find the make/break codes for the Spacebar. They are 39h and B9h.

The interrupt 9 service routine in the BIOS normally retrieves the scan codes from the keyboard and interprets them in conjunction with the status of the various shift keys. Codes that are not recognized by the BIOS, such as Ctrl-3, are ignored, and programs that use the BIOS keyboard services can never access them. If the key translates to an ASCII character, the BIOS places the ASCII code byte in the keyboard buffer, followed by the make scan code for that key.

If, however, the character is not ASCII, the BIOS places an "extended" ASCII code in the buffer, followed by a zero byte. You can use BIOS.COM to see the values the BIOS returns for each key. Figure 3 gives the source code for BIOS.ASM, while Figure 4 gives a BASIC program that will create BIOS.COM directly. Like SCAN, the values are displayed in hex, and pressing the Spacebar will exit the program and return to DOS. For the Spacebar, the BIOS returns 3920h.

Enhanced Keyboard users face an additional problem. To access the added keys (like F11 and F12), the new BIOS keyboard functions (10h, 11h, and 12h) must be used in place of 0, 1, and 2. A memory-resident patch was provided by Charles Petzold in PC Tutor, Volume 6 Number 13, to allow programs to take advantage of these new functions.

UNDERSTANDING OVERLAYS

What are overlay files, and how do they work?

Michael Gavin
New York, New York

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```
begin
clrscr;
writeln('                                                              ');
writeln('                          XO-SHELL                            ');
writeln('                                                              ');
writeln('  XO-SHELL is a removable memory resident program which provides the user the  ');
writeln('  following capabilities WHILE RUNNING an APPLICATION:        ');
writeln('                                                              ');
writeln('    ■ DIRECTLY FROM a SCROLLABLE DIRECTORY DISPLAY, you can view files, copy   ');
writeln('      files, erase files, change the default directory, and, when not in an   ');
writeln('      application, execute programs.                          ');
writeln('                                                              ');
writeln('    ■ You can DISPLAY ANY FILE, TRANSFER ANY SECTION of that file for PRINTING,');
writeln('      or transfer it to the keyboard for INPUTTING INTO YOUR EDITOR.          ');
writeln('                                                              ');
writeln('    ■ You can PRINT FILES WITHOUT LEAVING an APPLICATION. You can include a   ');
writeln('      header line, containing current date, title, file name, file creation   ');
writeln('      date and page number on every page of a list.           ');
writeln('                                                              ');
writeln('    ■ You can SEARCH STRINGS from a file or group of files that you specify;  ');
writeln('      you can do the MOST EFFICIENT CROSS-REFERENCING in the middle of        ');
writeln('      programming by searching variables from source files.   ');
writeln('                                                              ');
writeln('    ■ You can CREATE or EDIT FILES.                           ');
writeln('    ■ You can control and use your printer as a typewriter.   ');
writeln('                                                              ');
writeln('    ■ You can INPUT ANY IBM-PC CHARACTER as easily as you input regular ASCII  ');
writeln('      characters. You can easily draw vertical or horizontal lines in your    ');
writeln('      source code by choosing graphics characters from a pop-up window.       ');
writeln('                                                              ');
writeln('    ■ You can OBTAIN the KEY CODE of any key combination without looking up a ');
writeln('      reference or going through a difficult interpretation.  ');
writeln('                                                              ');
writeln('    ■ You can COLLECT the APPLICATION'S SCREEN displays in a file and later   ');
writeln('      edit or review them.                                    ');
writeln('                                                              ');
writeln('    ■ A DOS COMMAND EDITOR allows you to retrieve, edit and reexecute previous');
writeln('      DOS commands. It also PREVENTS an ACCIDENTAL HARD DISK FORMATTING.       ');
end.
```

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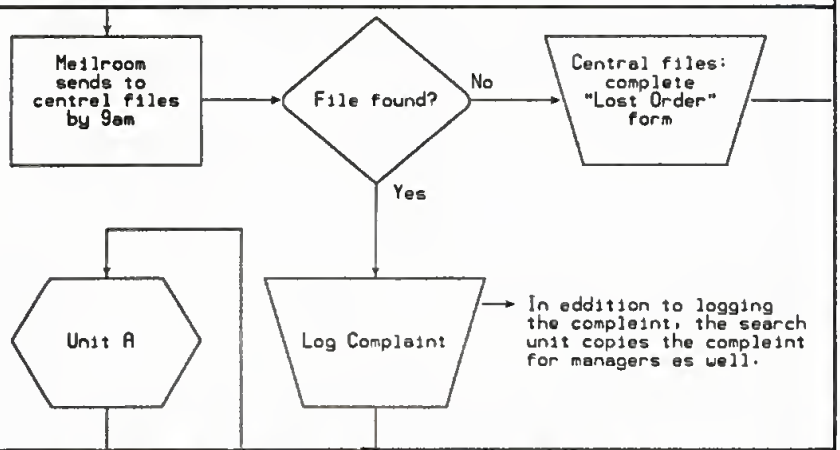

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■ PC TUTOR

Overlays are a way to run large programs in small amounts of memory. A program designed to use overlays will load some portions of itself into memory only when they are needed. The newly loaded sections write over (or "overlay") the same memory space as other parts of the program that are not currently needed. Using overlays can reduce the amount of RAM required for a program to run but can cause the program to execute more slowly because of the time needed to read the overlays from disk. A word processor, for instance, might keep the portion of its program related to printing in an overlay file and only load it when a request is made to print a file.

Although some programs, like WordStar, *use separate files to contain overlays, most higher-level languages allowing overlays use a single file. You can tell LINK to create an overlay by enclosing the object module names in parentheses.*

```
LINK ROOT + (OVRLAY1 + OVRLAY2) + SUB
```

Here, ROOT and SUB will always be in memory, and either OVRLAY1 or OVRLAY2 will be in memory at any one time, but not both.

The LINK program replaces any reference to a routine in an overlay with an interrupt. (The default is 3Fh.) The interrupt gives control to the Overlay Manager, which makes sure that the overlay containing the called routine is in memory. If not, it opens the file and loads it into the shared memory area. If the file cannot be found, the overlay manager will display an error message, or prompt you for a new file path.

Robert L. Hummel is senior technical editor on the staff of PC Magazine.

ASK THE PC TUTOR

The PC Tutor solves practical problems and explains points of general interest about using your hardware and software more productively and answers basic questions about DOS and systems in general. To see your questions answered here, drop a line to PC Tutor, *PC Magazine*, One Park Avenue, New York, NY 10016. We're sorry, but we cannot answer questions personally. PC

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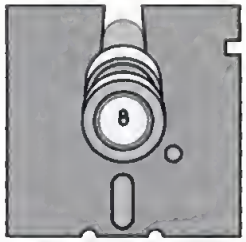

Explaining FCC fee increases for MCI, CompuServe, and other long-distance data calls; wiring for the future; exorcising LAN ghosts; and fine-tuning a LAN for speed.

INCREASED COSTS FOR DATA CALLS

I have heard that the FCC is going to impose a tax on the use of CompuServe, MCI Mail, The Source, and other services. Supposedly, the tax will raise the cost of these services by $5 a call. What is the story here and how can we fight it?

Chandler Mapes
Colorado Springs, Colorado

This is a complex issue, but yes, the cost of using information services could go up, and yes, there certainly are some things you can do about it.

Briefly, CC Docket 87-215 proposes removing an exemption to certain charges granted to a class of carriers called Enhanced Service Providers (such as Tymnet and Telenet).

These charges are not a tax. They are fees collected by your local telephone company for connecting the Enhanced Service Providers to you. Carriers like Tymnet and Telenet got a break from paying those fees in order to get started. Long-distance carriers like MCI, AT&T, and Sprint did not get this break, and you pay this fee now on every long-distance call.

This subject is coming up because U.S. District Judge Harold Greene is holding hearings on the Modified Final Judgment (MFJ) that broke apart the Bell System. Judge Greene is looking at letting the Regional Bell Operating Companies get into the "information transport services" (Tymnet and Telenet) and "electronic publishing" (The Source, CompuServe, DJIS) businesses.

Letting the big regional telephone companies into these businesses could stimulate competition, reduce costs, and provide better services. But the big guys can't be let loose if the present players are so weak that they have to be given favors. Therefore, the FCC is really looking at how strong the present Enhanced Service Providers are in order to determine if the Regional Bell Operating Companies should be let into the yard to play with them.

If your economic philosophy tends toward the doctrine of free trade, then you might want to support the docket and tolerate short-term cost increases to create a more active and creative industry. If you are happy with the present system (which I think is stagnant), then you should be firmly against imposing access charges on the Enhanced Service Providers. Either way, you can write directly to the Secretary of the Federal Communications Commission, 1919 M St., N.W., #222, Washington, DC 20554, in reference to CC Docket 87-215, and state your opinion.

■ If a location has a high level of electrical noise from industrial motors or radios, then for some data runs use more expensive shielded cable.

WHAT TO WIRE WITH?

We are relocating our office to a building under construction. We plan to have a small LAN with four or five users and a dedicated file server. We have not decided which LAN to go with, but would like to keep as flexible as possible until the dust settles. What do you suggest wiring with?

William Chilcote
Cleveland, Ohio

Because connectivity is a marketing strategy as well as a productivity strategy, the dust will never settle. Peering through the haze, however, it seems clear to me that plain old twisted-pair wiring will loom large in LAN development. 3Com has developed a high-speed, twisted-pair version of Ethernet. StarLAN products from Western Digital and Fox Research are good performers and low in price.

I suggest you wire each desk location with a minimum of four pairs of #24 AWG twisted-pair wire. (Belden No. 1154A is a good choice. This is what IBM calls Type 3 cable.) Putting two runs of four pairs each into each location at the same time would be a smart move. If the location has a high level of electrical noise from industrial motors or radios, then for some data runs consider using the more expensive shielded cable such as Belden 89688. This is IBM Type 1 cable.

If you have requirements for extremely high reliability, then jump past the thought of installing coax and go directly to optical

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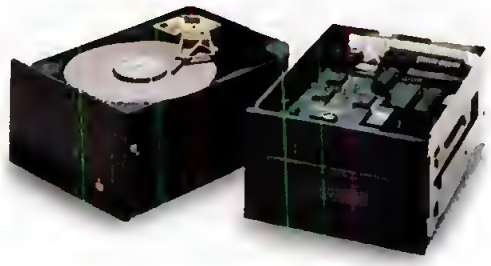

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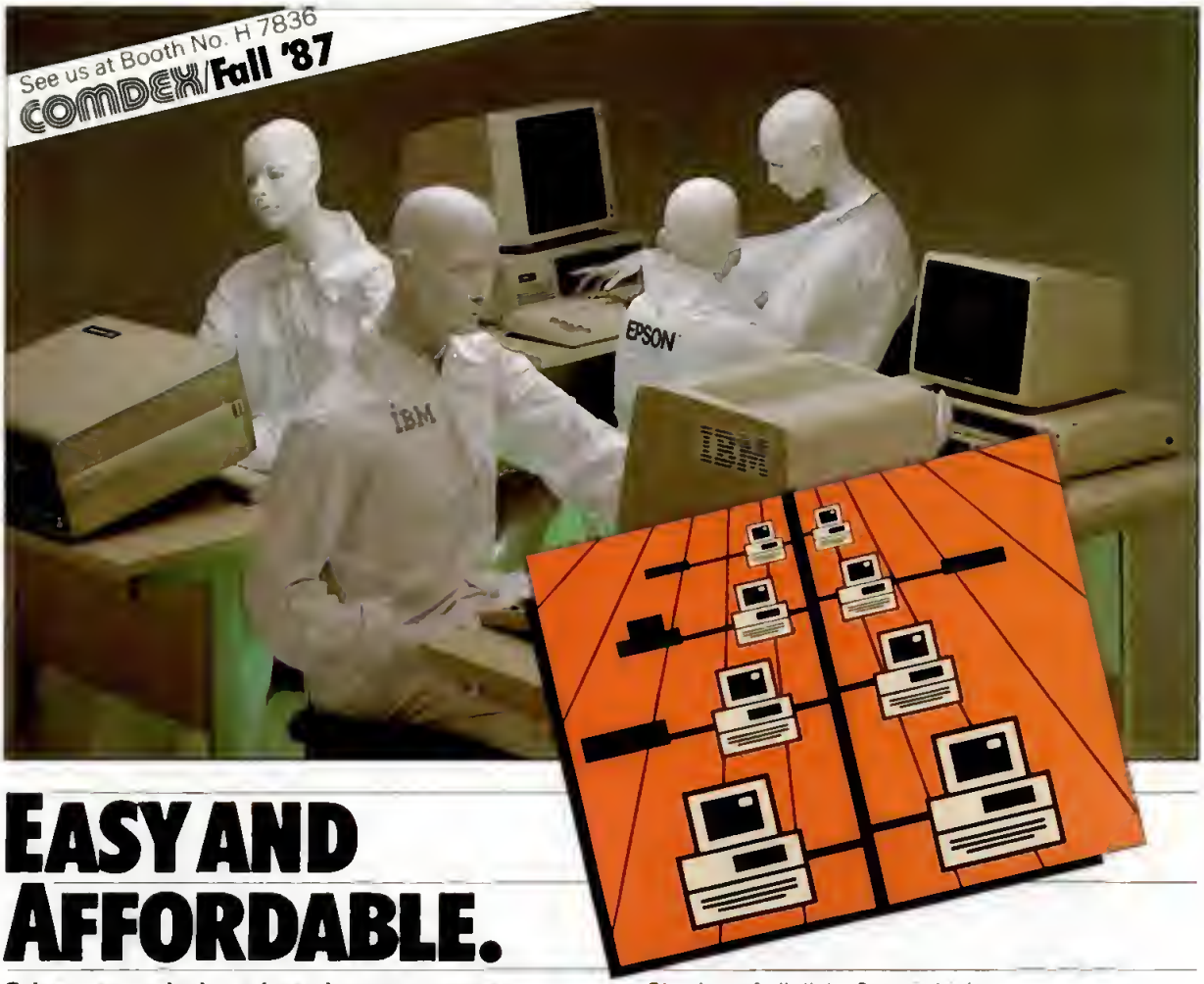

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■ CONNECTIVITY CLINIC

fiber. However, putting in optical fiber requires special planning and skill. You can call Codenoll Technology at (914) 965-6300 or Fibronics at (617) 778-0700 for more information.

GHOST STORY

It isn't Halloween, but here is a ghost story for you. Maybe others can benefit from our "haunting."

We have a StarLAN network with seven stations running off an AT server under *Advanced NetWare*. It worked well for 5 months. Then we noticed that the PC in the boss's office would sometimes mysteriously slow down or even refuse to sign on to the network. The behavior was odd because it happened only at night! We reinstalled the software and swapped complete systems, but no matter which PC we put on that desk, on some nights it would be haunted and freeze.

■ The PC in the boss's office would mysteriously slow down—but only at night!

It took a while, but we finally found the "ghost." A light dimmer in the wall was apparently putting out so much electrical noise that it "deafened" the StarLAN board. The dimmer controlled a desk lamp on a side table, and the lamp wasn't on during the day and often wasn't on at night. The dimmer was used before the mysterious problems on the network began, but a new cable-television connection was pulled through the ceiling past the dimmer and the desk.

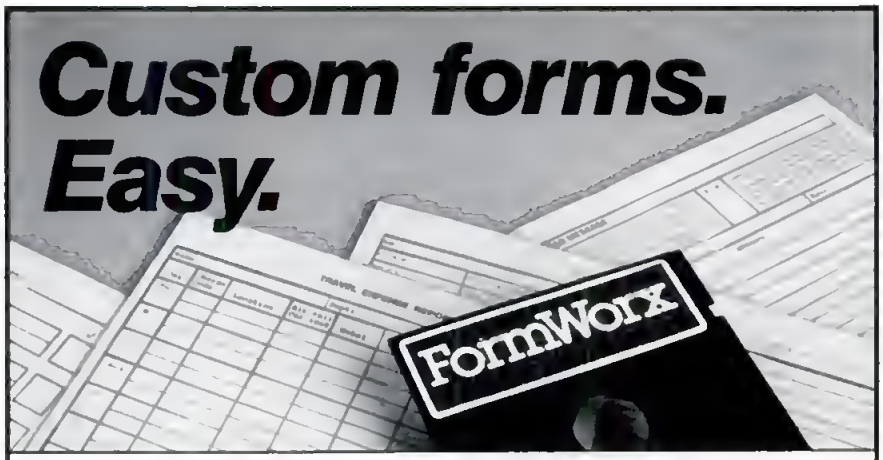
The proximity of the TV cable and the noisy dimmer put the hex on StarLAN when the dimmer was turned on. Replacing the dimmer with a standard wall switch exorcised the problem.

Thomas Babson
Cleveland, Ohio

That is a haunting story. Light dimmers and cable-television cables are both sources of RF noise. Moving either the data or the TV cable a few feet or changing their orientation toward each other (I bet they ran in parallel) would make a difference.

SLOW PC LAN

My company operates a network of eight microcomputers (used mainly for word processing) with a PC's Limited 286 as the server on IBM's broadband local area net-



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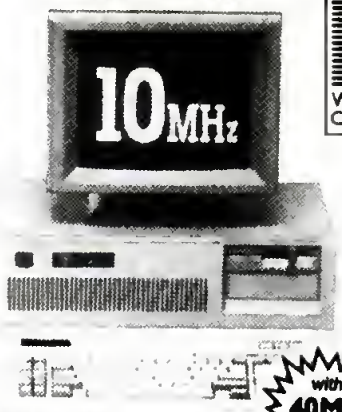

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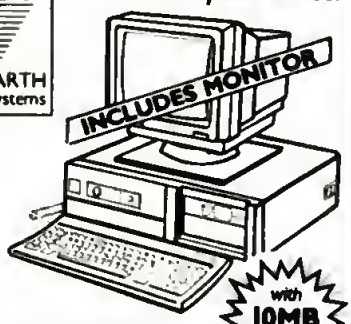

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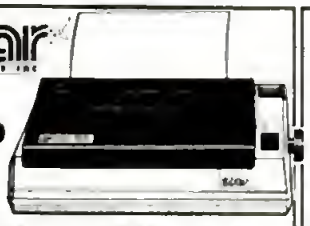

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CIRCLE 528 ON READER SERVICE CARD

■ CONNECTIVITY CLINIC

■ IBM's latest releases are for compatibility with new hardware and won't do a thing for the speed of your network.

work. The network is slow, but I wonder if IBM's networking announcements provide any inexpensive options for improvement. Would the new versions of DOS and the network program make a difference in performance?

David S. White
Ellicott City, Maryland

Unfortunately, the answer is no. IBM's latest releases are more for compatibility with new hardware and won't do a thing for the speed of your network. The PC's Limited 286 machine you are using as a server should do a good job with your word processing application. It appears you are using the server in the dedicated mode. Make sure that you have the networking software set up for dedicated operation. See Chapter 9 of the IBM manual for information on the buffers and file control blocks that should be allocated on a dedicated server configuration.

NETWORK YOUR QUESTIONS

Connectivity Clinic gives you practical solutions to networking problems of all types. We'll pay $50 or more for any tips we print, *plus an extra $25 if you submit your letter on a disk*, and we'll gladly answer any questions you have, at no charge. We're sorry, but we're unable to answer letters personally.

Mail your contributions to Connectivity Clinic, *PC Magazine*, One Park Avenue, New York, NY 10016, or you may contact Frank J. Derfler, Jr., via MCI Mail (be sure to use Derfler's box named CONNECTIVITY CLINIC).

Frank J. Derfler, Jr., is a contributing editor of PC Magazine.

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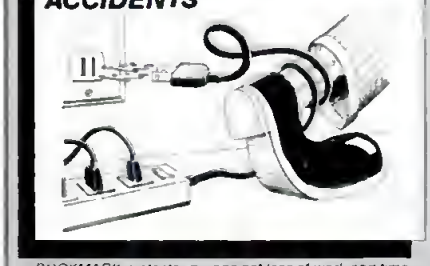

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CIRCLE 298 ON READER SERVICE CARD

HOW TO SUCCESSFULLY BUY THROUGH MAIL ORDER AND PROTECT YOUR RIGHTS

Mail order sales are governed by rules of the Federal Trade Commission (FTC) and various state laws. These guidelines are published as a service to you. Remember, the many vendors advertising in PC Magazine are eager to serve your needs.

FTC rules say:

1. The Seller must ship your order within 30 days of receiving it, unless the advertisement clearly states it'll take longer.

2. If it appears that your order will not be shipped when promised, the Seller must notify you in writing in advance of the promised date, giving a definite new date, if known, and offering you the opportunity to cancel the order with a refund or consent to a definite delayed shipping date or an indefinite delay.

3. The Seller's notice must contain a stamped self-addressed card or envelope with which you can indicate your preference. If you don't respond to this notice, the Seller may assume you agree to the delay, but must either ship or cancel your order within 30 days after the original shipping date promised or required. A prompt refund must be made when an order is cancelled.

4. Even if you've consented to an indefinite delay, you retain the right to cancel the order at any time before the item has been shipped.

5. If you choose to cancel an order, that has been paid for by check or money order, the Seller must mail you a refund within seven business days. If you cancel an order for which you paid by credit card, the seller must credit your account within one billing cycle following receipt of your request. Store credits or vouchers in place of a refund are not acceptable.

6. In the event that the item you ordered is unavailable, the Seller may not send you substitute merchandise without your express consent.

TIPS WHEN ORDERING

When ordering by mail:

State precisely what merchandise you want, specifying details such as model, make, size, component parts, etc.;

Confirm the price and expected delivery date as stated in the ad;

Indicate whether you will accept a substitute product if the item you ordered is unavailable, and, if not, that your payment should be returned;

Don't send cash, you will have no record of payment if a problem arises, and;

Keep a copy of your order and all other correspondence with the Seller. Your records should include the company's name, address and phone number; a description of the item ordered; your cancelled check or a copy of the money order; record of the date you mailed the order; and any sales slips and shipping receipts.

When ordering by phone:

Note the time and date of your conversation and the name of the person you talk with;

Make a record of your order, the price, its promised availability and the components to be expected;

Save all correspondence associated with your order, including your cancelled check or a copy of the money order, and any written confirmation sent by the Seller.

Questions you should consider asking:

Does the advertised item come with all necessary parts and accessories? Are they from the same manufacturer?

Is it available for immediate shipping?. If not, when will it be available?

Has there been an increase in the advertised price?

What warranties does the item carry? Who provides the service?

What is the Seller's return policy?

What is the Seller's refund policy?

With whom should you correspond if there is a problem?

IF YOU HAVE PROBLEMS:

1. If you have not received your order as promised or if the item is defective, immediately notify the Seller in writing referring to your order by description, price, date, as well as by account number and order number, if available. Make sure you keep a copy of the letter.

2. If you complain by telephone, send a follow-up letter to confirm what was said.

3. If you think the merchandise is defective, reread your product instructions and your warranty carefully to be sure you don't expect features or performance the product isn't designed to give. Then contact the Seller for instructions. Don't return it to the Seller until you have been instructed to do so.

4. When returning merchandise make sure you keep the shipper's receipt or packing slip; your right to be reimbursed for postal cost is determined by store policy.

5. If you have completely discussed your problem with the Seller and are still not satisfied, write to the consumer complaint agency in the Seller's state. If you paid for the merchandise by credit card, you may have rights to withhold payment under a Federal law called the Fair Credit Billing Act.

PC Magazine's Direct Marketing Connection

For PC Products and Services

For many of you, mail order is your primary means of purchasing PC products and services.

In fact, in recent interviews with our subscribers, we learned that 70% bought PC products and services through direct marketing channels during the past year.*

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The following special section, PC Magazine's Direct Marketing Connection, is what you've been demanding. It connects you with the direct marketers who are anxious to please you. By having them all in one place, you can quickly zero in on the products you need from the vendors you want to buy through.

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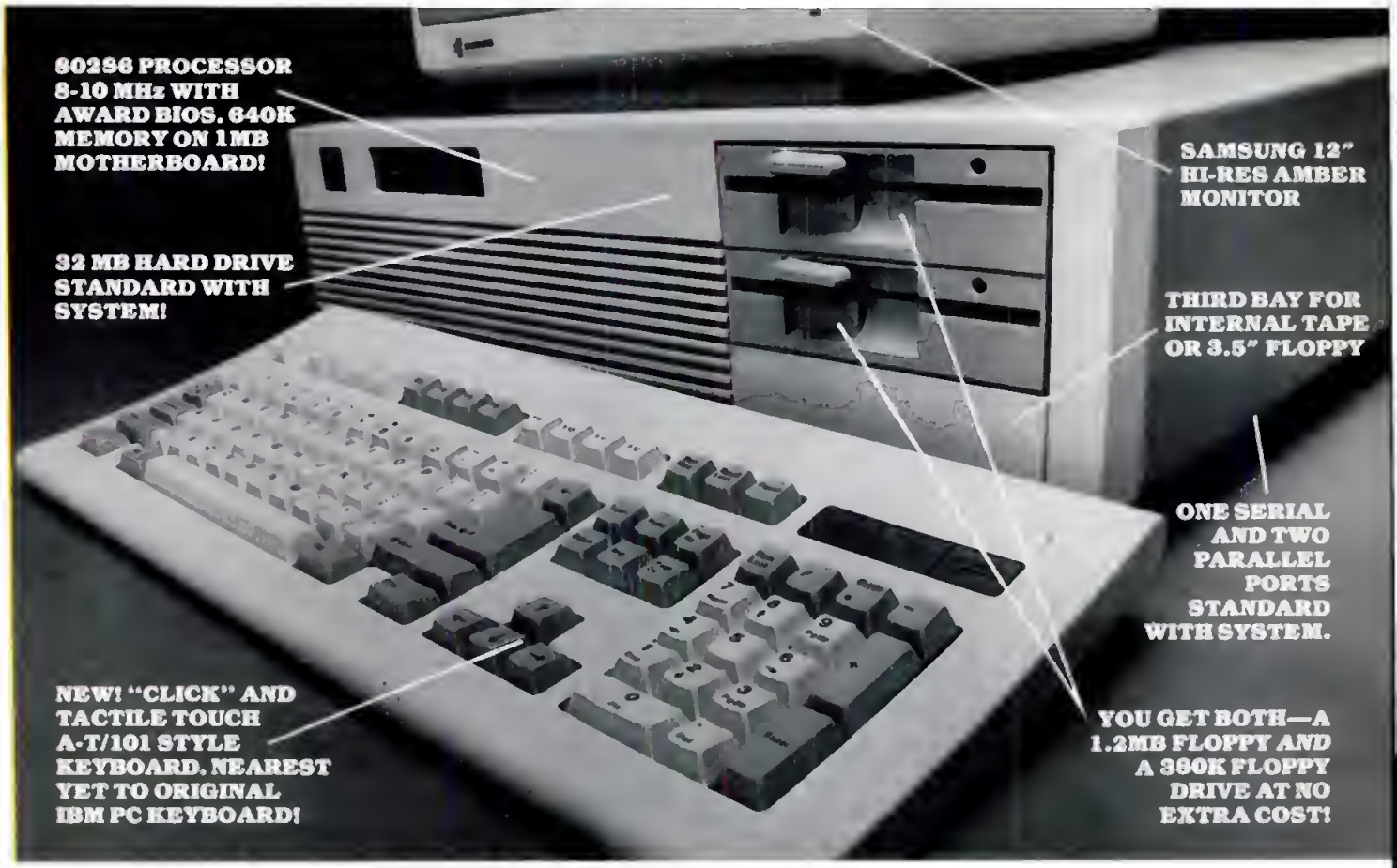

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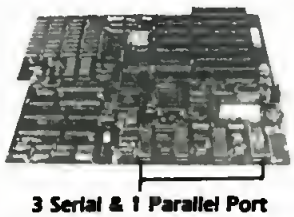

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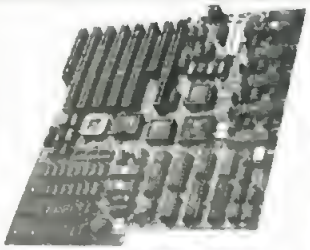

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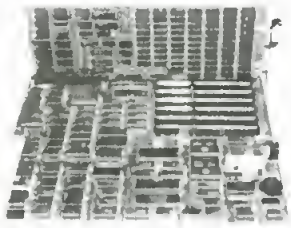

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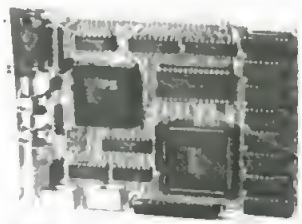

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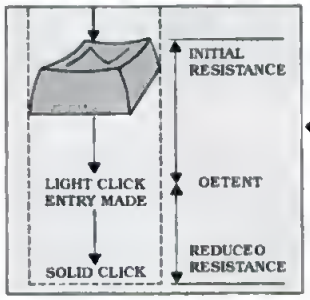

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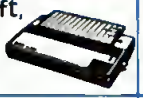

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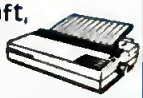

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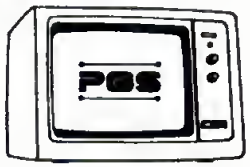

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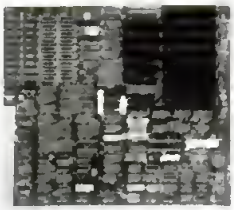

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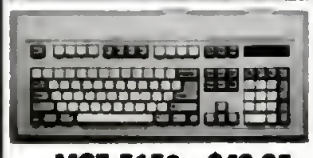

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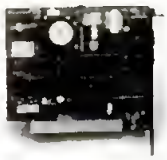

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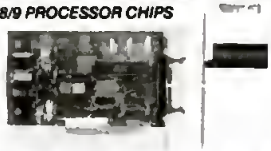

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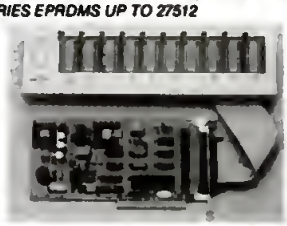

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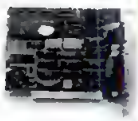

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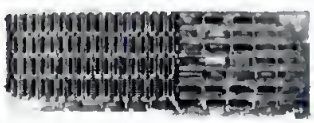

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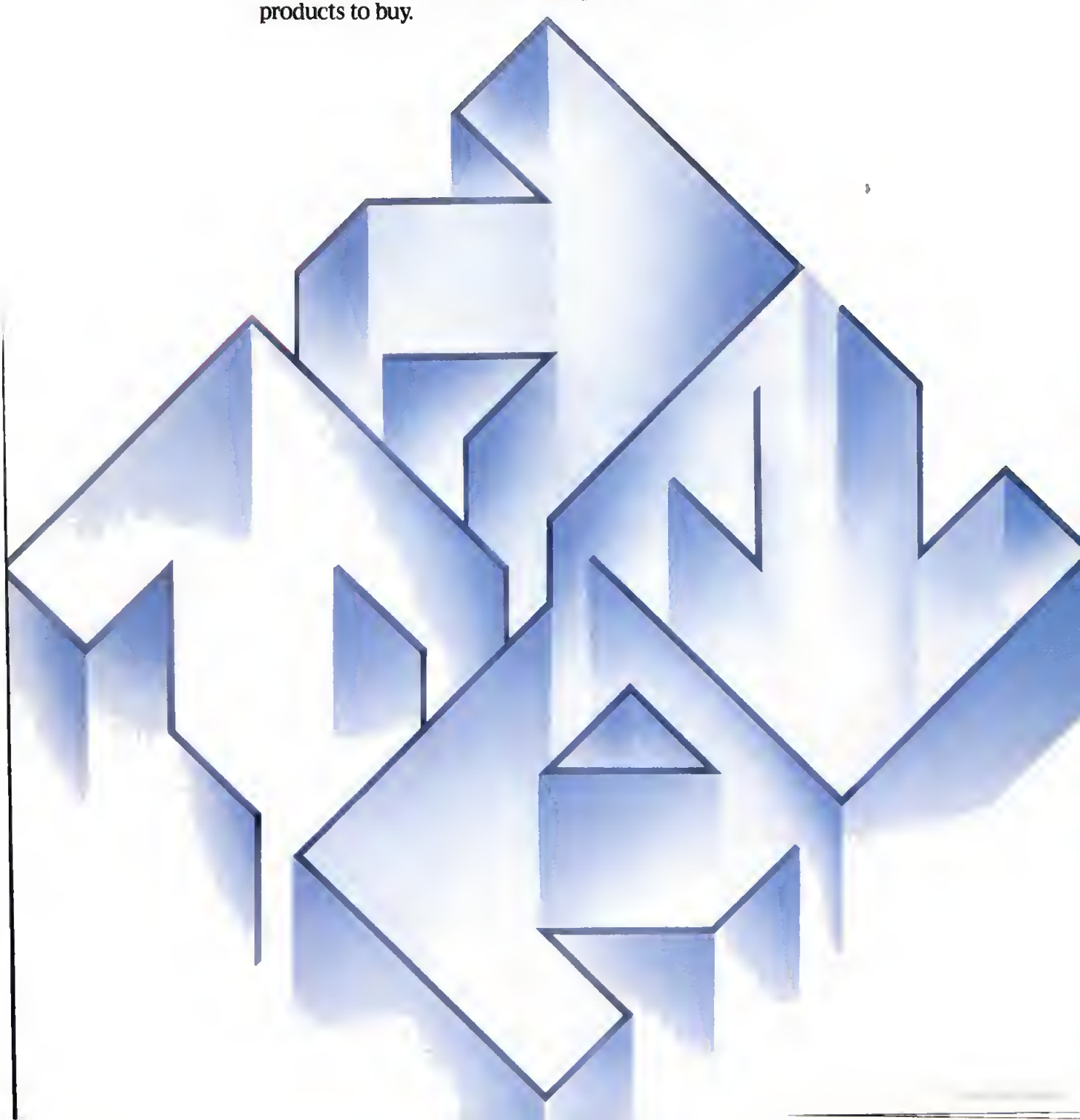

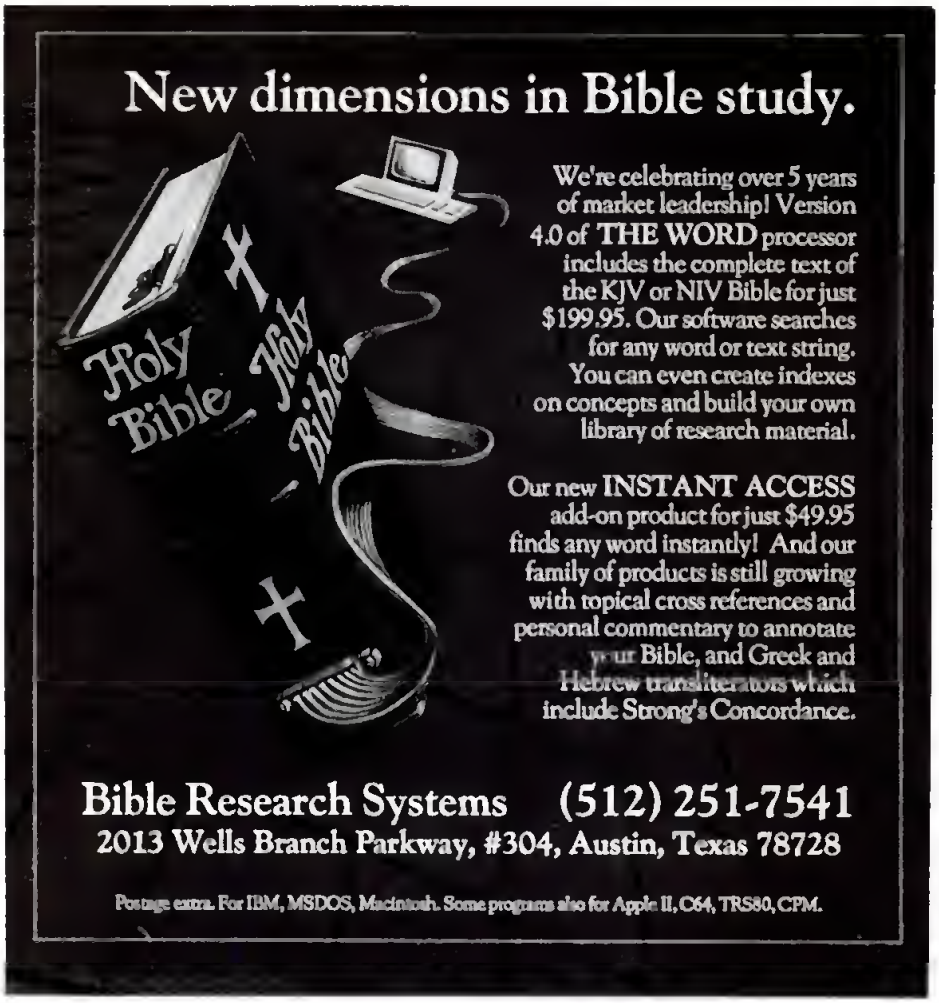

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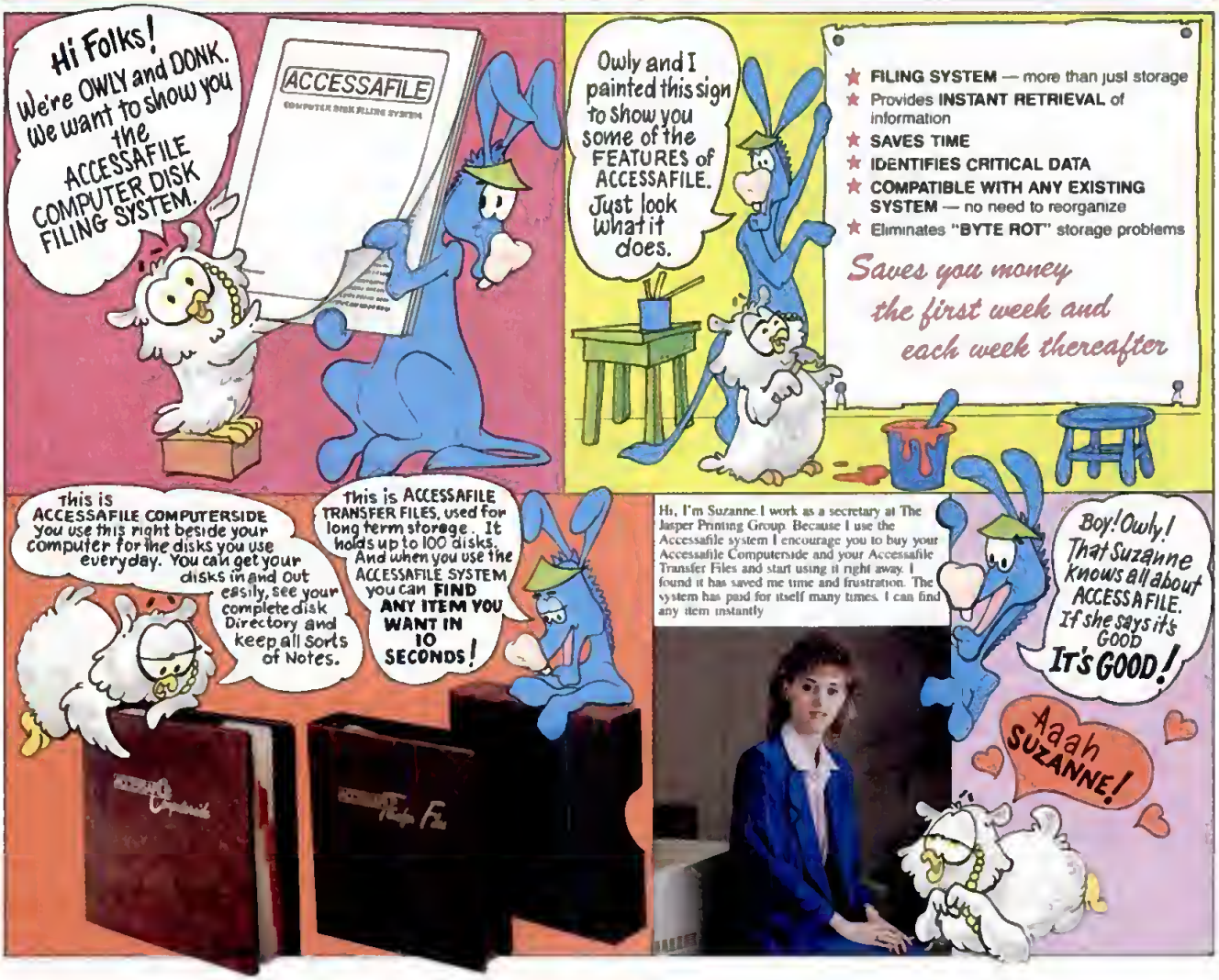

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CIRCLE 185 ON READER SERVICE CARD

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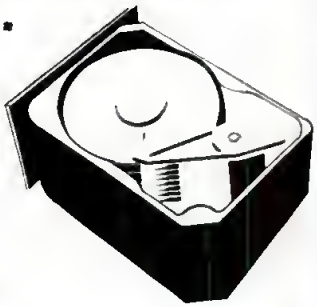

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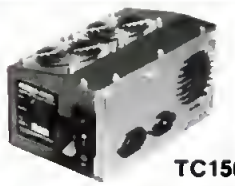

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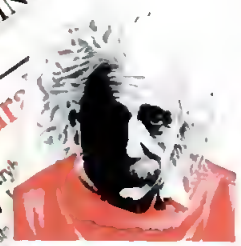

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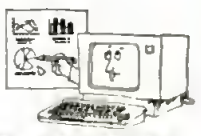

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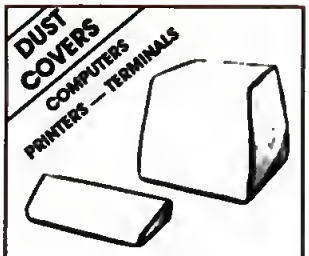

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MEDIA INTELLIGENCE

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COMING UP

FOURTH ANNUAL PRINTER BLOCKBUSTER ISSUE It's printer roundup time again. For the last 3 printer issues *PC Magazine* has worked to bring its readers current, informative, and painstakingly researched reviews. We're pleased to say that once again this goal will be met. In our fourth annual printer blockbuster issue, PC Labs and our crew of 12 reviewers torture-tested 106 laser, dot matrix, and daisy wheel printers.

LASERS Laser printers, once a luxury item, have increased their market share in 3 years by offering more-competitive list prices and increased performance. Joining the Hewlett-Packard LaserJet Series II (the undisputed torch-bearer) are 35 other printers, among them some rugged enough to be departmental machines and others flexible enough for desktop publishing.

DOT MATRIX Dot matrix printers could easily be compared to a daily morning run. They jog along in NLQ mode or sprint at draft speed, and given the decibel level of most impact printers, they really get your blood moving. This year we'll review 65 printers, many of which offer some nice surprises, such as smaller footprints, more standardized features, improved paper-handling, and color options. Included in this group are two special-purpose machines: one that offers both daisy wheel and dot matrix printheads and one that uses thermal transfer technology.

DAISY WHEELS Although daisy wheel printers were once the only show in town for letter-quality printing, competition from high-end dot matrix printers and low-end lasers threatens their existence. We review five new daisy wheels that belong to a soon-to-be-extinct species.

NEW BELLS AND WHISTLES In this issue you'll also find a historical index that features all of the printers that we've reviewed over the past 3 years that are still available on the market. And the printer guide and features tables are jam-packed with information that will help you in any future purchasing decisions.

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1. In which of the following sectors does your organization operate? (Check one.)
- a. ☐ Private Industry
- b. ☐ Government
- c. ☐ Education

2. Your primary job function is (check one):
- d. ☐ MIS/DP, Communications Systems, Programming
- e. ☐ Engineering/R&D
- f. ☐ Finance/Accounting
- g. ☐ Marketing/Sales
- h. ☐ Administrative/General Management

3. Is your company a reseller?
- i. ☐ Yes
- j. ☐ No

4. For how many IBM PC's and compatibles do you buy products?
- k. ☐ 10 or less
- l. ☐ 11-25
- m. ☐ 26-100
- n. ☐ 100 or more

5. Are PC's in your office
- o. ☐ Linked to mainframe
- p. ☐ Linked to mini
- q. ☐ Networked together

6. Does your company own
- r. ☐ Mainframe(s)
- s. ☐ Mini(s)

7. Do you plan to to buy
- t. ☐ Now
- u. ☐ In 4 to 6 months
- v. ☐ In 6 to 12 months
- w. ☐ No definite plans

8. Number of employees in your company:
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- y. ☐ 26-99
- z. ☐ 100-499
- 1. ☐ 500-999
- 2. ☐ 1000 or more

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p. ☐ Linked to mini
q. ☐ Networked together
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u. ☐ In 4 to 6 months
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w. ☐ No definite plans
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AFTER HOURS

FINE DINING

New York Restaurants Categorized and Critiqued

BY EDWARD MENDELSON

Looking for a New York restaurant that features mud wrestling? Or a spot where you'll find computer types among the clientele? You can search these and hundreds of other categories in the database that comes with *Cuisine America's Appetite for Business: New York 5000*. This program lists every eatery in Manhattan, and a few nearby.

As you might expect, *Cuisine America* uses a lot of menus. Like the menus in expensive restaurants, they are not always easy to understand. The appetizer menu is a screen that lets you decide whether to search for a restaurant according to its cuisine, price range, hours, locale, beverage selection, or other general category. You press the Enter key to select each of the general categories from which you want to narrow your choices and then move on to the more detailed menus in the main course. Here you choose among a bewildering variety of restaurant types until at last you zero in on the place you're looking for.

At each stage, a counter indicates the number of restaurants that fit your needs. If you go to the Cuisine menu and select Indonesian food, the counter reports three available choices. If you go to the Atmosphere menu and select Romantic, the counter reports 30. (It also reports four that are Hostile and two that are Boring.) The Clientele menu reports that the database includes 81 places frequented by Yuppies. You can combine categories from different menus to focus your choice even further.

When the descriptions finally appear on your plate, they prove to be expert, if a bit overenthusiastic—and you can add your own sweet or sour commentary with a built-in editor.

As for the few places that *Cuisine America* doesn't like at all, it's probably a good idea to avoid them. I expect to stay far away from a punk rockers' hangout that the program describes as "ugly, unpleasant, and unappetizing."

Cuisine America comes in three sizes, with lists of 500, 1,500, and 5,000 restaurants. The largest database actually includes 4,918 restaurants (29 are McDonald's), but only a fraction are indexed under anything more than a name and address. As a result, many of the search categories may remind you of dishes that sound appetizing on a menu but are not available from the kitchen. If you actually search for those mud-wrestling or cha-cha restaurants through the Features menu, you will find that the program doesn't know where to find anything of the kind.

List Price: *Cuisine America's Appetite for Business: New York*, 500-restaurant version, $69.95 (no updates available); 1,500-restaurant version, $150 (plus $100 for four quarterly updates); 5,000-restaurant version, $250 (plus $150 for four quarterly updates). **Requires:** 512K RAM, hard disk drive with 2.6 Mbytes of free space, DOS 2.0 or later. Not copy protected. Cuisine America, 245 E. 63rd St., #1723, New York, NY 10021; (212) 935-3427.

CIRCLE 678 ON READER SERVICE CARD

A series of menus lets you narrow down your choice of cuisine, location, and ambience before the program provides its critique.

Plywood Planner *isn't sophisticated, but it is handy. This decimal-to-fraction converter for inches is a perfect example.*

GAMES

Plywood Planner: Work Saver for Weekend Carpenters

BY GUS VENDITTO

If you've got pieces of wood scattered in and around the basement, leaning against the garage, stacked beneath the porch, and rotting underneath the backyard shrubs, you could use *Plywood Planner*.

Like a union worker, it performs but one job: recording cuts in your sheets, automatically adding the saw kerf, to maintain a woodpile database. But it does that job diligently and without fuss. Ask for optimization before you start sawing, and the program will point out a more economical way to cut. Or have it search its database to find the size you need from the old stock, and it can save you from starting on a new sheet.

That's all.

If you keep it up-to-date, *Plywood Planner* can stave off the headache of running out of stock when you've got six or seven too-short pieces scattered around.

It's a cinch to use—that is, if your PC's within extension-cord range of your power tools. And if you've gotten serious about cleaning up the yard.

List Price: *Plywood Planner*, $24.95. **Requires:** 128K RAM; DOS 2.0; CGA, EGA, or Hercules graphics. Coiner Computer Systems, Landmark Pavilion, #7, 150 Robbins Station Rd., North Huntingdon, PA 15642; (412) 864-0480.

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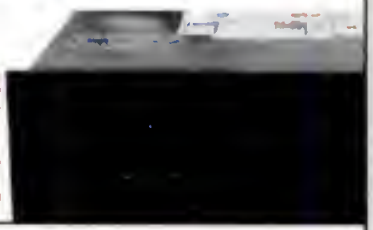

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AFTER HOURS

GAMES

Cheap Thrills with Leisure Suit Larry

BY NEIL RUBENKING

With *Leisure Suit Larry in the Land of the Lounge Lizards*, Sierra On-Line dares to ask the question, "What do you want, good graphics or good taste?" Clearly the answer is, "Good graphics!" When you play it, you take on the persona of Larry Laffer, traveling salesman. Larry has come to Lost Wages, Nevada, for one night. His aim: maximum fun.

In the course of the game, Larry meets a number of ladies. Fawn, the blonde gold digger, wants to get hitched. Faith, the security guard, stays true to her boyfriend. Larry isn't truly happy until he reaches the penthouse and hops into the hot tub with Eve, the quiet one.

On the way to the penthouse, Larry has to deal with the usual dangers of Lost Wages. Slot machines, drunks, and bad cabaret acts.

The documentation says the game requires a CGA, EGA, or Hercules adapter. In fact, it will be disappointing on a CGA. The ladies don't look right with magenta/cyan/white complexions. But in the EGA mode the graphics really shine.

Some of the content is a bit risqué. If there were a ratings board for animated adventures, *Larry* would get slapped with an R. Since there isn't, Sierra uses a unique system to protect young innocents. Upon starting the game, you have to correctly answer five trivia questions. The questions are designed to be easy for an adult, but not for a youngster. Precocious teens, however, will have little trouble fooling the game. (A sample question: Who was Spiro Agnew?)

Leisure Suit Larry is significantly less complex than Sierra's other games, so it makes a good introduction to animated adventure gaming.

List Price: *Leisure Suit Larry in the Land of the Lounge Lizards*, $39.95; Hint Book, $7.95. **Requires:** 256K RAM; CGA, EGA, or Hercules adapter; one disk drive; joystick optional. Includes both 5¼- and 3½-inch disks. Copy protected. Sierra On-Line Inc., P.O. Box 485, Coarsegold, CA 93614; (209) 683-6858.

CIRCLE **680** ON READER SERVICE CARD

Larry's search for happiness in Lost Wages, Nevada, may lead to a wedding chapel; other diversions are casinos, discos, and bars.

GENEALOGY

Charting a Family's Progress

BY GREG PASTRICK

The things we do in the name of family. As a loyal husband, father, son, grandson, brother, nephew, and cousin, I would do many things for my extended family—but tinkering with the myriad options and settings of *Family Roots* to get a complete family history just about drove me into hiding.

This compiled QuickBASIC program offers a complete family historical record database system in three disks. On one hand, it is a thorough system for recording and printing the generational information of any family. On the other, if you're just looking to establish a family tree and record generational details, it's a program that's more difficult and time-consuming to use than pen and paper.

Family Roots is based on a suite of record-specific programs (Edit, Freeforms, Structures, Persons, Groups, Lists, and Search) and a group of utility programs (Manager, Toppers, Create, Blanks, Renumber, Addresses, Reader, Viewer, What, Empties, and Fixer) that can be accessed from the main menu.

Record entry is straightforward and aided by automatic prompts, but can be redundant if you choose not to enter records logically or by groups. Linking of individual records is done by entering the record number (not the name) for mother, father, and children in the appropriate field for each record. Once it's done, all related files are updated, but it's a constant process of editing.

Freeforms and Structures are the fruits of your labor. With Freeforms you can print descendant and pedigree charts. Structures prints ancestor charts and a compressed or listed pedigree (you'll need to buy a separate $49.95 charting option to print your family tree, though).

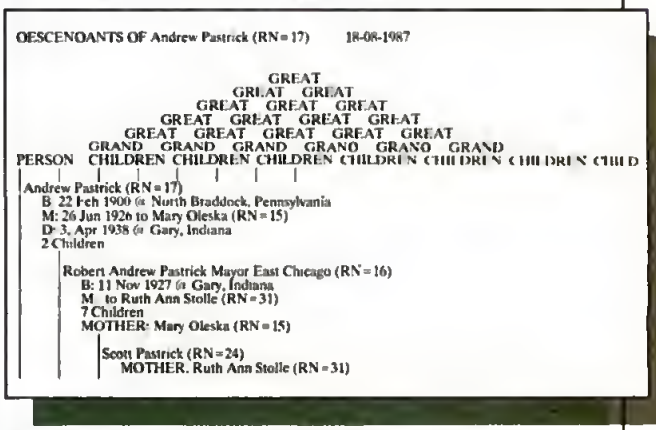
The program's power comes from Lists, Search, and Reader, which help you analyze your family structure. Finally, Search retrieves record information based on just about any relationships or criteria you can come up with.

The program would be much easier to use if you didn't need to adjust parameters so often—there's too much room for tinkering at all points.

You'll get your family history down pat, but *Family Roots* will make you work at it.

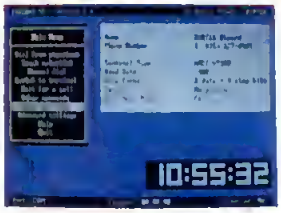
List Price: *Family Roots*, $185; Tree Charts, $49.95. **Requires:** 256K RAM, DOS 1.1 or later, printer. Not copy protected. Quinsept Inc., P. O. Box 216, Lexington, MA 02173; (617) 641-2930.

CIRCLE **679** ON READER SERVICE CARD



Family Roots *printouts can be unwieldy; this is the heading for a three-page genealogical chart.*

Main Menu and Autopilot



Freeway's pop-up menus and windows make communications fast. With the "autopilot" you can automate any communications sequence, without programming scripts, simply by going through the sequence once.

Phonebooks

Freeway stores the numbers and settings for up to 108 systems. You simply pick the number you want and hit Enter; Freeway dials.

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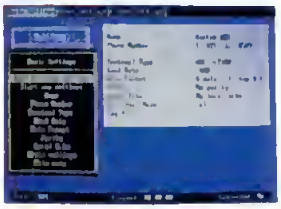

The parameters you need are gathered in simple menus. You simply zip through with arrows and Enter and save settings in the Phonebooks.

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AFTER HOURS

PERSONAL GROWTH

Exercises at the Keyboard: Typing Programs That Mix Work with Games

BY MITT JONES

For years Simon & Schuster's *Typing Tutor* series has reigned as the undeniable king of PC typing-tutorial software, helping to indoctrinate the worst two-finger typists in the ways of touch typing and promising to sharpen the skills of even the most nimble-fingered typists.

With its new *Typing Tutor IV*, Simon & Schuster hopes to continue the royal tradition. But an aggressive newcomer, Broderbund's *Type!*, presents itself as a serious challenger to the throne.

Each package offers gentle, slow-moving exercises for beginners, advanced lessons for the agile-fingered, progress charts, and typing games that ease the pain of practice. Each boasts the smarts to track your progress and your weaknesses and offers lessons tailored to your needs. But the programs differ in the additional features they offer and in their approach to training your fingers to do what they're told.

Type!'s practice game adds drama to the finger exercises: two runners illustrate your speed at matching the display with keystrokes.

Typing Tutor IV

Typing Tutor IV prompts you to register your name and choose a level of proficiency—beginner, two-finger typist, or touch typist—the first time you use the program. As many as eight people can register their names. *Typing Tutor* tracks each person's progress and offers appropriate levels of lessons and tests.

Once past the preliminaries, those who admit to either of the lower proficiency levels get lessons and practice tests on keyboard fingerings.

Self-proclaimed touch typists first take a speed test that gauges their proficiency and spots weak points. The program then offers lessons that concentrate on those weaknesses.

Typing Tutor's random sentence generator, one of the enhancements over *Typing Tutor III*, keeps advanced lessons interesting by supplying a seemingly endless amount of new text to type, but beginners and two-fingered typists have to put up with meaningless letter combinations until they reach a certain level of proficiency.

During all lessons and tests, *Typing Tutor* displays the characters you're to type with the letters you actually type on a line underneath. When you make a mistake, you can continue typing or backspace to correct the error.

Letter Invaders—a game that's seriously addictive for anyone who likes to type—lets you break from lessons for a little fun.

A takeoff on *Space Invaders*, Letter Invaders advances letters and words toward your "terrain." You try to save your terrain from destruction by correctly typing the letters and words, thereby destroying them.

Typing Tutor IV *borrows a page from* **Space Invaders:** *you must correctly type the word heading toward you to destroy it.*

Type!

You choose from a full-page menu to access *Type!*'s nice assortment of features. Beginners will want to start with the lessons that introduce the keyboard and concentrate on fingerings. More-advanced typists will want to jump to the speed and accuracy lessons and special exercises that let you concentrate on specific fingering or areas of the keyboard.

During all exercises and tests, *Type!* displays the text you're to type but doesn't display what you type. When you make an error, you get only an arrow pointing at the letter you mistyped.

Unlike *Typing Tutor*, *Type!* prohibits you from backspacing to correct errors.

An image of the keyboard occupies a portion of the display during most of the program. In theory, the keyboard image trains you not to look at your fingers by showing you key placements on the screen.

After each lesson or exercise, *Type!* suggests an exercise based on your progress.

Like *Typing Tutor*, *Type!* offers several typing tests and progress reports. You can also create your own tests. However, *Type!* gives you a much broader range of exercises.

Type!'s game falls short of Letter Invaders by a long shot, but it should keep you interested for a while. Type!-Athlon is a track game in which the faster and more accurately you type, the faster your runner runs.

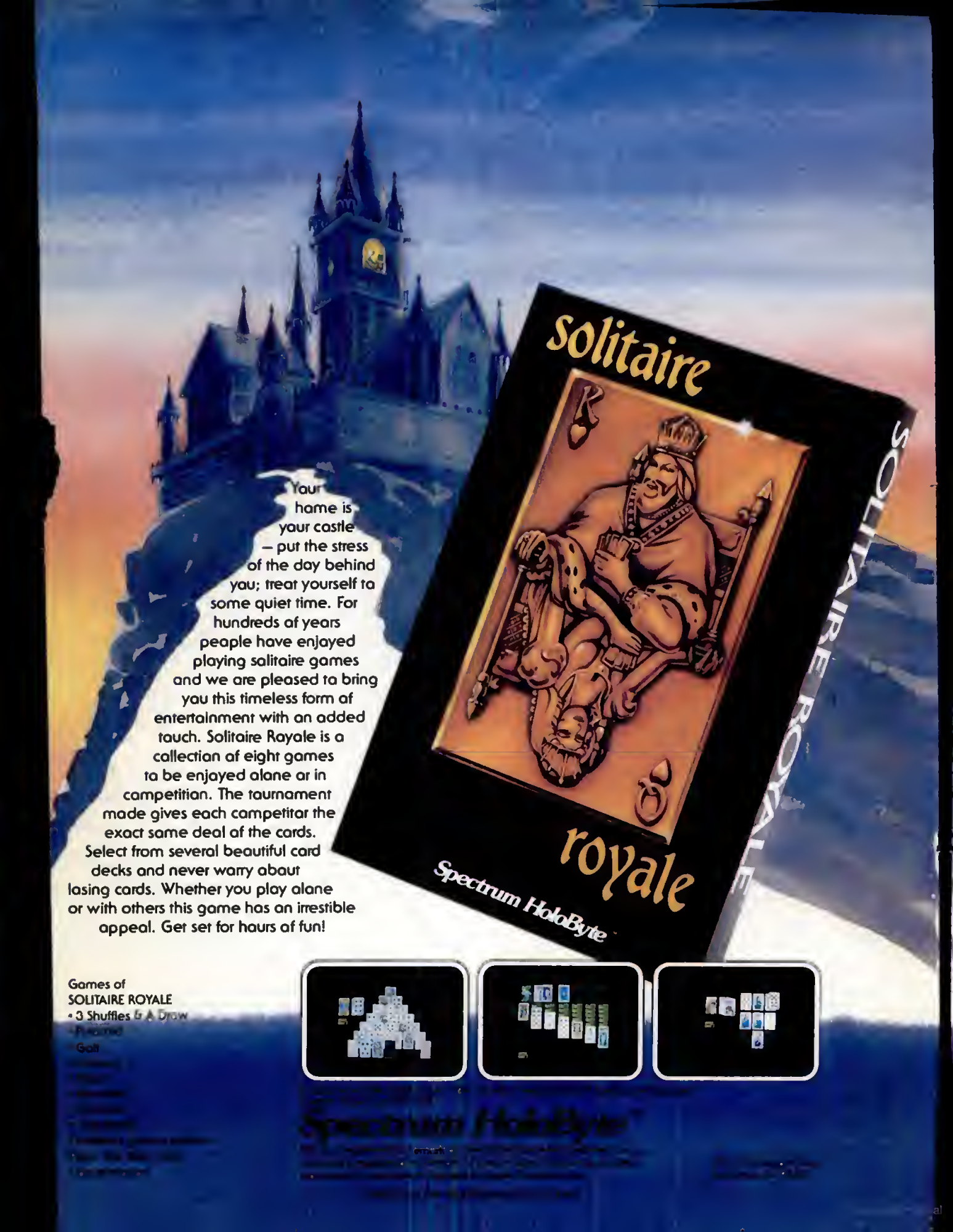
Either of these programs will help you build your typing skill if you take the time to use them. *Type!* boasts more features, but I preferred *Typing Tutor IV*. It frustrated me not to be able to backspace to correct my errors or see what I typed when using *Type!*.

List Price: *Type!*, $49.95. **Requires:** 128K RAM, DOS 2.1 or later, standard QWERTY keyboard. Broderbund Software Inc., 17 Paul Dr., San Rafael, CA 94903-2101; (415) 492-3500.

CIRCLE **636** ON READER SERVICE CARD

List Price: *Typing Tutor IV*, $49.95. **Requires:** 128K RAM, DOS 2.0 or later, standard QWERTY or Dvorak keyboard. Simon & Schuster Software, 1 Gulf + Western Plaza, New York, NY 10023; (800) 624-0023; (800) 634-0024 in N.J.

CIRCLE **681** ON READER SERVICE CARD



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PERSONAL FINANCE

The American Investor: Playing the Market, Without the Risk

BY DONALD B. TRIVETTE

How would you like to amass a tidy Wall Street portfolio without risking any money? Impossible? Not if you have Blue Chip Software's *The American Investor*, a simulation of the American Stock Exchange that not only teaches you the ins and outs of the securities market, but entertains in the process.

You begin by allocating yourself a dollar amount from which you can purchase any of the 47 securities, 21 options, or 4 indices built into the game. These include Aetna Life, American Express, Chevron, Disney, Echo Bay Mines, E.F. Hutton, Texas Air, and the S&P 500. Although billed as a simulation of the American Stock Exchange, the seasoned investor will recognize a number of issues trading on the New York Exchange. No matter: both exchanges operate under similar rules.

Not wanting to appear too greedy, I initialized my portfolio with a mere $100,000 and began trading.

I invested (or should I say blew?) all my capital on stock options. Options are one of the few legal ways to make a lot of money in a short period of time (most of the other legal ways are found in Atlantic City and Las Vegas). With 100 Calls for Disney and Motorola in my account, I rapidly advanced the calendar, day by day, and watched my fortune shrink.

When it fell to $42,000, I considered dumping everything and starting over. In real life, that's exactly what I would have done, and that's the reason I've sworn off option trading. Instead I held on and turned to the manual.

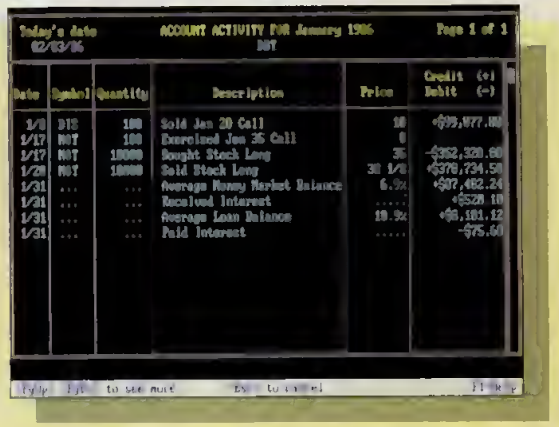
The American Investor's manual is divided into two parts. The first 50 pages describe how to initialize and play the game; the second part is a 70-page booklet explaining everything from the basics of investing to strategies for writing Puts and Calls. The simulation is so easy to run that all your effort can be spent on trading.

To my astonishment—and just days before the expiration dates—the market recovered and my fortune soared to $146,794. But I wasn't paying close attention and didn't sell my Motorola options before they expired. I had to purchase 10,000 shares at $35 a share. As in real life, I had to borrow the money (margin), and the program charged me interest over the weekend; it also computes and charges commissions.

In every way but one, *The American Investor* is an accurate simulation: Can you believe that when I sold the stock on the following Monday it had gone up $3 a share? My little mistake made me an extra $30,000.

List Price: *The American Investor*, $149.95 **Requires:** 512K RAM, two disk drives, DOS 2.0 or later. Copy protected. Blue Chip Software, 185 Berry St., San Francisco, CA 94107; (800) 572-2272; (415) 546-1866 in Calif.

CIRCLE **662** ON READER SERVICE CARD



The American Investor *is smart enough to remember to bill you for commission and interest on loans—without asking for approval, of course.*

Fundamentalists vs. Technicians

Stock market investors and speculators come in two flavors. The technician believes the market's future performance can be predicted solely by charts and graphs that show its past activity. The fundamentalist, on the other hand, relies on basic data like earnings, cost of goods, and projected sales for making investment decisions. Although most of us fall somewhere in the middle of these two extremes, *The American Investor* covers both sides nicely. Since the whole point is to learn about the market, the game encourages you to try approaches you might hesitate to explore in real life.

For the fundamentalist, there's background information on each company, its financial history, an industry analysis, and actual news headlines from the period being simulated. Any of these can be summoned from the menu by the familiar point-and-shoot method. For the technician, there are enough charts to run a small hospital. At the touch of a key, the computer draws moving averages, trading bands, trend lines, and point/figure reverses. In both cases, the information and quotations are from the years 1981 to 1984. Armed with all this data, it's your problem to decide what to buy, when to buy, and when to sell.
—Donald B. Trivette

AFTER HOURS INDEX

The American Investor
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Typing Tutor IV
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A walk on the wild side
Family Roots
Putting your tree in order
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We eased the learning process by giving you the best support around. We completely revised our documentation. The new Mixed Language Programming Guide gives you step by step instructions for linking your assembly code with Microsoft QuickBASIC, C, FORTRAN, Pascal and other languages. And you get a comprehensive reference manual with listings of the instruction set and examples of each instruction. We didn't stop there, though. You also get an on-disk collection of templates and examples.

We've also dramatically simplified the high-level language interface. In just a few simple steps, you can be calling Macro Assembler subroutines from programs written in your favorite language.

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And you'll be glad to know that you don't sacrifice any speed for all the ease of use.

We took the fastest Macro Assembler on the market and made it even faster.

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